DOCUMENT RESUME

ED 261 258 CE 042 505

TITLE Advanced Technical Drafting (Industrial Arts) Curriculum Guide. Bulletin 1751.
INSTITUTION Louisiana State Dept. of Education, Baton Rouge. Div. of Vocational Education.
PUB DATE 85
NOTE 204p.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC09 Plus Postage.
DESCRIPTORS Architectural Drafting; Behavioral Objectives; Cartography; *Charts; Computer Oriented Programs; Course Descriptions; Course Objectives; *Drafting; Geometry; Graphic Arts; High Schools; *Industrial Arts; Learning Activities; Safety; State Curriculum Guides; Technical Illustration; Transparencies

ABSTRACT

This curriculum guide contains materials for a 17-unit course in advanced technical drafting, a followup to the basic technical drafting course in the industrial arts curriculum for grades 10-12. It is intended for use by industrial arts teachers, supervisors, counselors, administrators, and teacher educators. A three-page course overview provides a brief course description; indicates target grade level, prerequisites, course goals, and course objectives; presents an introduction to the course; and suggests a time frame. The detailed, nine-page course outline follows. A unit teaching guide in a column format relates objectives to topics, student activities, teacher activities, and resources. The 17 units cover these topics: review of basic technical drafting, functional drafting, inking, surface development and intersections, secondary auxiliary views and revolutions, graphic charts and diagrams, detailed thread representation, map drafting, basic descriptive geometry, electrical and electronic drafting, technical illustration, architectural drafting, pipe drafting, aerospace drafting, structural drafting, computers in design and drafting, and welding drafting. Extensive appendixes include a tool list, safety information, suggested assignments (problems) from texts, over 80 pages of sample work sheets, crossword and wordfind puzzles with solutions, and a bibliography. (YLB)

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1985

ADVANCED TECHNICAL DRAFTING

(Industrial Arts)

CURRICULUM GUIDE

Office of Vocational Education

Bulletin 1751
LOUISIANA
SCHOOLS

CE042505

LOUISIANA DEPARTMENT OF EDUCATION

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STATE OF LOUISIANA

DEPARTMENT OF EDUCATION

BULLETIN 1751

ADVANCED TECHNICAL DRAFTING
(Industrial Arts)

1985

Office of Vocational Education

Elaine Webb, Ed.D.
Assistant Superintendent

Thomas G. Clausen, Ph.D.
State Superintendent

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FOREWORD

This publication is a guide for the improvement of instruction in Industrial Arts Education for the State of Louisiana. It should be of benefit to industrial arts teachers, supervisors, counselors, and administrators. These operational guidelines will help local administrators, teacher educators, and industrial arts teachers to determine the extent to which their programs are meeting the needs of our youth. Industrial Arts Education Programs must be organized to meet the needs of all students.

A constant concern of educators is the construction and revision of curriculum. Industry and technology are the core of industrial arts instruction. Both are constantly changing; therefore, curriculum and instruction must change in order to provide students a realistic and accurate understanding of industry and its function in our complex technological society.

Thomas G. Clausen

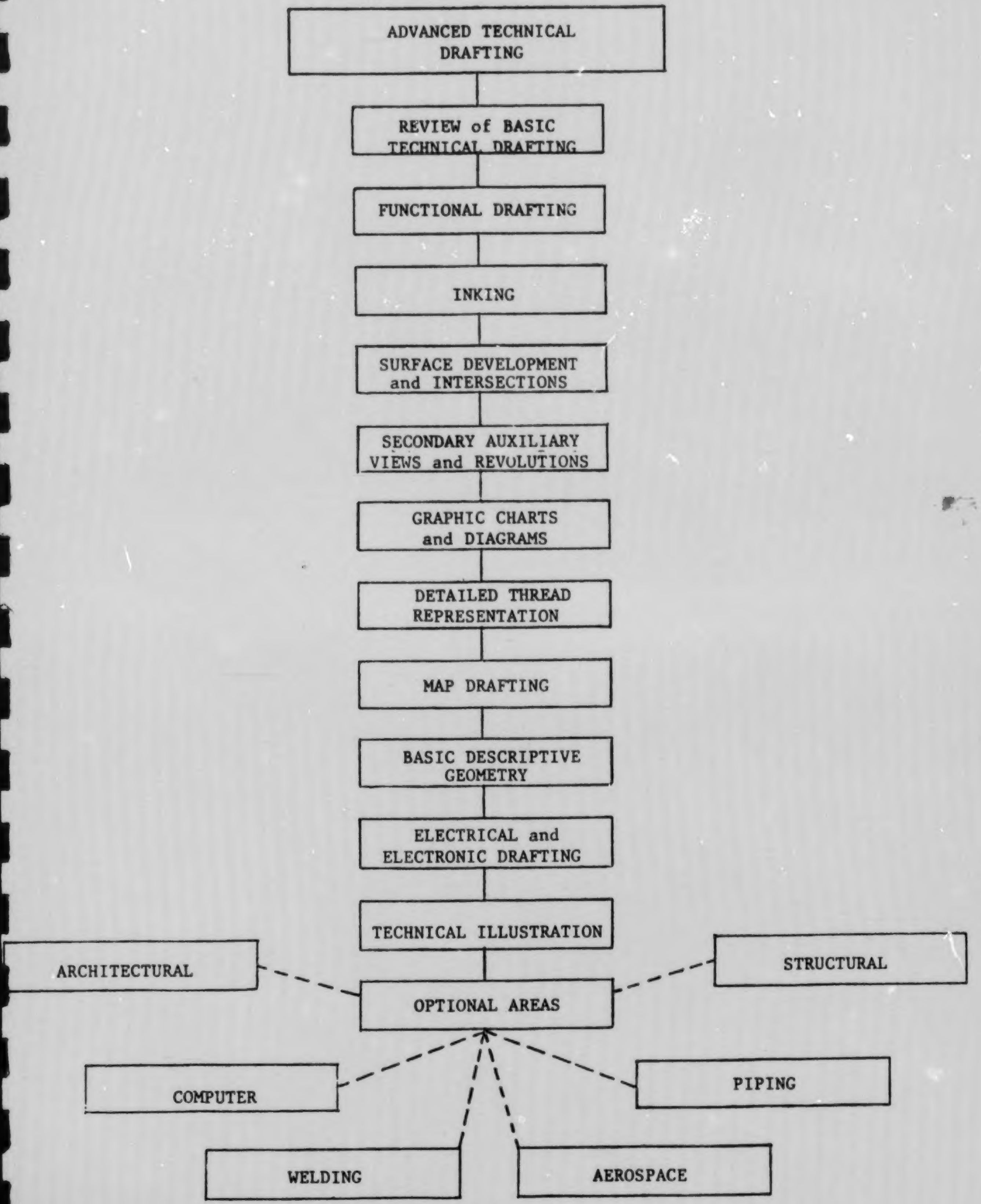
THOMAS G. CLAUSEN, Ph.D.
STATE SUPERINTENDENT OF EDUCATION

ACKNOWLEDGEMENTS

This publication represents the cooperative efforts of personnel in the Louisiana Industrial Arts Association and the Industrial Arts Section in the Office of Vocational Education, Louisiana State Department of Education. Special recognition goes to Project Director, Dr. Thomas L. Eppler, Northwestern State University, who was instrumental in the development of the guide. Special commendation goes also to the following writing team members who worked diligently to produce this guide: Bill Bischoff, Johnny Hamilton, and Dennis Robbins.

Elaine Webb

Elaine Webb, Ed.D.
Assistant Superintendent
Office of Vocational Education


ADVANCED TECHNICAL DRAFTING
REVIEW of BASIC TECHNICAL DRAFTING
FUNCTIONAL DRAFTING
INKING
SURFACE DEVELOPMENT and INTERSECTIONS
SECONDARY AUXILIARY VIEWS and REVOLUTIONS
GRAPHIC CHARTS and DIAGRAMS
DETAILED THREAD REPRESENTATION
MAP DRAFTING
BASIC DESCRIPTIVE GEOMETRY
ELECTRICAL and ELECTRONIC DRAFTING
TECHNICAL ILLUSTRATION
ARCHITECTURAL
STRUCTURAL
OPTIONAL AREAS
COMPUTER
PIPING
WELDING
AEROSPACE

Title:

Advanced Technical Drafting

Course Description:

Advanced technical drafting is designed as a follow-up to basic technical drafting. It is a graphic language used to convey necessary and specific information that expresses and records ideas for those who produce, use, and service products.

Advanced technical drafting involves the preparation of detailed drawings including inking, surface development, intersection, graphic charts, diagrams, threads, map drafting, descriptive geometry, electrical/electronic drafting, and secondary auxiliary view and revolutions. A survey of specialized areas, such as pipe, architectural, aerospace, computer, welding, and structural drafting, is also included.

Target Grade Levels:

This course is designed for students in grades 10, 11, and 12.

Prerequisite:

Basic Technical Drafting

General Program Goals:

In advanced technical drafting, the student will have an opportunity to develop additional skills in drafting techniques from the fundamentals of drafting through the technical aspects of drafting.

Specific Objectives:

1. To review the following areas of Basic Technical Drawing: safety, orthographic projection, dimensioning, pictorials, sectional drawing, and working drawings.

2. To recognize situations in which functional drafting techniques may be used effectively and prepare a functional technical drawing for that situation.

3. To describe the need for, and uses of, inked drawing and make an inked drawing of high quality.

4. To visualize the surface development of three-dimensional objects and make accurate surface developments using parallel-line development, radial-line development, and triangulation.

5. (A) To describe the use of the auxiliary projection plane, explaining the relationship to the regular planes, and explain the use of three types of auxiliary reference planes.
   (B) To provide information on the revolution, defining surfaces and other features and the relation of this method to drafting and design.

6. To read, interpret, and construct basic graphic charts and diagrams.

7. To make drawings of threads using detailed thread representation.

8. To provide information on the techniques used in making the various kinds of maps and the methods of gathering map data.

9. To graphically define the basic geometric elements and shapes, make drawings of the three basic lines, make drawings of an oblique plane, describe principles of geometric location, and prepare a drawing that covers the four fundamentals of solving all descriptive geometry problems.

10. To provide information on the various kinds of electrical and electronic drawings and on electrical and electronic components, units, and sub-assemblies, their symbols, and designations.

11. To describe the nature and use of technical illustration and provide information on basic techniques used in technical illustration.

Introduction:

Advanced Technical Drafting is a course designed to expand upon the information presented in Basic Technical Drafting. The content is such that it has value for those who plan to work in any phase of industry, including positions in engineering, management, education, skilled or semi-skilled occupations, office work, sales and promotion, service and repair, and many other fields. Each student is given the opportunity to expand the ability to express ideas in pictorial form, to describe the shape of objects through the use of drawings, and to read and to understand projection methods. Technical accuracy is necessary, and related mathematics, science, and technical vocabulary are taught simultaneously with practical activities.

This curriculum guide and outline will serve as a guide for teaching Advanced Technical Drafting. The implementation of the objectives and activities presented in this guide is recommended for the development of the advanced technical drafting student.

This curriculum guide will cover two semesters of work for one unit of credit. This course is open to all tenth, eleventh, and twelfth grade students that have successfully completed Basic Technical Drafting. The class should meet one hour per day, five days per week for 36 weeks (180 days).

TIME FRAME

	Orientation	2 Hours
Unit I	Review of Basic Technical Drafting	10 Hours
Unit II	Functional Drafting	10 Hours
Unit III	Inking	5 Hours
Univ IV	Surface Developments and Intersections	15 Hours
Unit V	Secondary Auxiliary Views and Revolutions	15 Hours
Unit VI.	Graphic Charts and Diagrams	15 Hours
Unit VII	Detailed Thread Representation	18 Hours
Unit VIII	Map Drafting	15 Hours
Unit IX	Basic Descriptive Geometry	15 Hours
Unit X	Electrical and Electronic Drafting	15 Hours
Unit XI	Technical Illustration	15 Hours
Optional Areas plus time used for opening and closing of school, school activities, or for placing extra emphasis where the instructor deems necessary		30 Hours
	Total	180 Hours

ADVANCED TECHNICAL DRAWING

A YEARLY OUTLINE

I. REVIEW OF BASIC TECHNICAL DRAWING

A. Safety in the Drafting Room

1. Student responsibilities
2. Safe use of equipment

B. Orthographic Projection/Multiview Drawing/Shape Description

1. Three-view projection
2. Alphabet of lines

C. Dimensioning

D. Pictorials

1. Use of pictorial drawing
2. Types of pictorial drawing
   a. Isometric
   b. Oblique
   c. Perspective

E. Sectional Drawing

1. Purpose of sectional drawing
2. Types of sectional drawing
   a. Full
   b. Half
   c. Offset
   d. Broken out
   e. Removed

F. Working Drawings

1. Applications of working drawings
2. Methods of layout

II. FUNCTIONAL DRAFTING

A. Classes of Functional Drafting

1. Class 1: In-company or local working drawing
2. Class 2: For fields of industry or engineering
3. Class 3: General functional

B. Simplified Drafting

1. Definition
2. Functionalism
3. Utility

C. Unnecessary Views and Detail

D. Other Simplified Techniques

1. Base-line dimensioning
2. No arrowheads
3. Templates
4. Timesaving symbols

E. Overlays

1. Composite overlay
2. Pressure-sensitive overlay

F. Tape Drafting

1. Opaque
2. Transparent

III. INKING

A. Nature and Purpose of Inked Drawings

1. High quality tracings
2. Copying methods

B. Drawing Ink

1. Special characteristics
2. Types of ink

C. Basic Inking Instruments

1. Ruling pens
2. Technical pens
   a. Kinds of points
   b. Advantages

D. Basic Techniques for Inking Straight Lines

E. Basic Techniques for Making Circles and Arcs

F. Order of Inking

1. Arcs
2. Horizontal lines
3. Vertical lines
4. Remaining lines

IV. SURFACE DEVELOPMENTS AND INTERSECTIONS

- A. Drafting for Sheet Materials
- B. Development of Seams and Laps
- C. Parallel-line Development
  1. Cylinder
  2. Two-piece, or square, elbow
  3. Four-piece elbow
- D. Radial-line Development
  1. Cones
  2. Pyramids
- E. Triangulation
- F. Intersections
  1. Prisms
  2. Cylinders
  3. Combinations

V. SECONDARY AUXILIARY VIEWS AND REVOLUTIONS

- A. Secondary Auxiliary Projection
- B. Axis of Revolution
  1. Axis perpendicular to horizontal
  2. Axis perpendicular to vertical
  3. Axis perpendicular to profile
- C. Rules of Revolution
  1. View unchanged except in position
  2. Distance parallel to axis unchanged
- D. Kinds of Revolution
  1. Single revolution
  2. Successive revolutions

VI. GRAPHIC CHARTS AND DIAGRAMS

- A. Line Charts
  1. Trends or changes
  2. Steps in drawing

B. Engineering Charts

   1. Experimental information
   2. Nomographs

C. Bar Charts

   1. Definition
   2. Types
      a. One-column
      b. Two-column
      c. Horizontal bar
      d. Multiple-bar
   3. Steps in drawing

D. Pie Charts

   1. Definition
   2. Steps in drawing

E. Pictorial Charts

   1. Definition
   2. Examples

F. Organization and Flow Charts

   1. Definition
   2. Examples

VII. DETAILED THREAD REPRESENTATION

A. Schematic Representation (Review)

B. Simplified Representation (Review)

C. Drawing Detailed Representation Screw-Threads

   1. Sharp V
   2. Square screw threads
   3. Acme screw threads

D. Screw Thread Norms

   1. Thread series for Unified and American National Standard Screw threads
   2. Classes of fits for Unified and American National Standard Screw threads
   3. Screw-thread specifications

E. Specifying Fasteners

1. Lock nuts
2. Cap screws
3. Machine screws
4. Set screws
5. Wood screws
6. Keys
7. Rivets

VIII. MAP DRAFTING

A. Careers in Mapping

1. Civil engineering
2. Draftsman under the supervision of the design engineer

B. Scales and Map Size

1. Decimals
2. Kilometer
3. Graphic scale

C. Contour Maps

1. Lines of constant level
2. Spacing
3. Technical pens
4. Surveying

D. Geological Mapping

1. Makeup and structure of the earth surface and interior depths
2. Geological surface map
3. Geological sections

IX. BASIC DESCRIPTIVE GEOMETRY

A. Points

1. Definition
2. Projections
3. Fixed points

B. Basic Lines

1. Normal
2. Inclined
3. Oblique

C. Planes

  1. Definition
  2. Basic planes
     a. Plane one (normal)
     b. Plane two (inclined)
     c. Plane three (oblique)

X. ELECTRICAL AND ELECTRONICS DRAFTING

A. Career Opportunities

  1. Preparation
  2. Electrical or electronic draftsman
  3. Electronic environment

B. Terms for Understanding Electricity and Electronics

  1. Electricity
  2. Voltage and current
  3. Resistance
  4. Units
  5. Formulas

C. Graphic Symbols

D. Circuits

  1. Series
  2. Parallel
  3. Combination

E. Drafting Practices

F. Diagram Procedure

  1. Single-line
  2. Schematic or elementary
  3. Connection or wire
  4. Interconnection

G. Printed-Circuit Drawings

IX. TECHNICAL ILLUSTRATION

A. Definition

B. Kinds of Illustrations

  1. Pictorial
  2. Cutaway assembly
  3. Exploded assembly

        4. Hidden and telltale sections
        5. Peeled section
        6. Film slides and transparencies

    C. Tools, Equipment, and Supplies

    D. Line Shading

        1. Definition
        2. Types of air burshes
            a. Oscillating needle
            b. Pencil type
            c. Poster type
        3. Air supply
        4. Supplies and materials
        5. Procedure for air brushing

XII. ARCHITECTURAL DRAFTING

    A. Defined

    B. Architecture Evaluated

        1. Show functional patterns
        2. Well engineered
        3. Aesthetic value

    C. Basic Drawings

        1. Plan (floor)
        2. Elevation
        3. Perspective
        4. Exterior wall section

    D. Styles of House Construction

XIII. PIPE DRAFTING

    A. Types of Pipe

        1. Steel
        2. Cast iron
        3. Copper
        4. Plastic

    B. Pipe Connections

        1. Screwed
        2. Flanged
        3. Welded
        4. Soldered
        5. Bell and spigot
        6. Cementing

C. Pipe Fittings

D. Valves

1. Gate
2. Globe
3. Check

E. Pipe Drawings

1. Single-line orthographic
2. Double-line orthographic
3. Single-line isometric
4. Double-line isometric

F. Dimensioning

G. Sizes of Standard Pipe

XIV. AEROSPACE DRAFTING

A. Major Aircraft Components

1. Wings and airfoil
2. Landing gear
3. Power plant

B. Aircraft Drafting Practices

C. Undimensioned Drawings

D. Typical Drawings

XV. STRUCTURAL DRAFTING

A. Type of Work Performed (Structural Draftsman)

1. As a detailer in an architect's or engineer's office
2. Construction company's shop drawing
3. Government and agencies which control construction and design of public buildings, bridges, and other structures

B. Structural Steel Shape

1. ASTM
2. AISC

C. New Vocabulary Words

XVI. COMPUTER DRAFTING

A. Definition of Terms

1. Computer
2. Design drafter
3. Documents
4. Automated design
5. Programmer
6. Program
7. Computer language
8. On-line operation
9. Off-line operation

B. Function of Computer-Aided Design in Drafting

C. How the Computer Functions in Computer Graphics

D. Digitizer

1. Manual digitizer
2. Mechanized or automated digitizer

E. Artwork Generators

F. Automatic Drafting Machines

G. Plotters

H. Computer Graphics and the Drafter's Future

XVII. WELDING DRAFTING

A. Welding Processes

1. Fusion
2. Gas
3. Arc
4. Thermit
5. Gas and shielded arc
6. Resistance

B. Welding Drawing Symbols

C. Welded Joints

1. Butt
2. Lap
3. Corner
4. Edge
5. T

ORIENTATION: RULES, REGULATIONS, AND SAFETY 2 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to identify the state, parish, school, and room rules and regulations, (including basic safety rules) that apply to the drafting room.	State Rules Parish Rules School Rules Classroom Rules (including basic safety)	Read and sign rules and regulations handout sheet.	Discuss the various rules and regulations that apply to your particular situation. Make handout sheets for students to read and sign, including general rules, regulations, and basic safety rules.	State Handbook Parish Handbook School Handbook Book 17, p. 1A Example in Appendix

UNIT I: REVIEW OF BASIC TECHNICAL DRAFTING 10 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: work safely in the drafting room. carry out the student responsibilities. use the drafting equipment safely. show knowledge of orthographic projection/multiview drawing/shape description.	A. Safety in the Drafting Room 1. Student responsibilities 2. Safe use of equipment	Record safety rules in notebook.	Discuss the various safety rules and regulations that apply to the drafting room *Demonstrate the proper use and care of the drafting equipment.	Book 13, pp. 25-36
show knowledge of three-view projection. list all kinds of lines listed in the alphabet of lines.	B. Orthographic Projection/ Multiview Drawing/Shape Description 1. Three-view projection 2. Alphabet of lines		*Discuss orthographic projection using the text and reference material. Demonstrate the three basic views: top, front, and right side. List all lines included in the alphabet of lines.	Book 4, pp. 93-113 Book 8, pp. 92-113 Book 18, pp. 73-84 Book 15, pp. 155-176 Book 12, pp. 83-101 Book 17, pp. 30A-30F Book 17, p. 30C Book 7, p. 97
demonstrate a knowledge of dimensioning and dimensioning practices.	C. Dimensioning		Discuss dimensioning and dimensioning practices using the text book and reference materials.	Book 4, pp. 114-144 Book 8, pp. 131-190 Book 15, pp. 177-198 Book 18, pp. 124-144 Book 12, pp. 141-167 Book 3, p. 117

*Audiovisual Aids

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
demonstrate a knowledge of pictorial drawings and their use. identify the three kinds of pictorial drawing.	D. Pictorials 1. Use of pictorial drawing 2. Kinds of pictorial drawing a. isometric b. oblique c. perspective		*Discuss pictorial drawing including its kinds: isometric, oblique, and perspective. Illustrate example of each type.	Book 4, pp. 246-275 Book 8, pp. 226-253 Book 15, pp. 133-141 Book 18, pp. 26-36, 85-92 Book 12, pp. 307-339
demonstrate a knowledge of sectional drawing. identify the kinds of sectional drawing.	E. Sectional Drawing 1. Purpose of section drawing 2. Kinds of section drawing a. full b. half c. offset d. broken out e. removed		Discuss sectional drawing including its types: full, half, offset, broken out, and removed. Illustrate examples of each type.	Book 4, pp. 184-197 Book 8, pp. 254-282 Book 15, pp. 229-256 Book 18, pp. 96-105 Book 12, pp. 193-210
demonstrate a knowledge of working drawings.	F. Working Drawings 1. Applications of working drawing 2. Methods of layout		*Discuss working drawing applications and methods of layout. Illustrate examples on board.	Book 4, pp. 227-245 Book 8, p. 131 Book 15, pp. 6, 34, 99, & 495 Book 12, pp. 267-305
		Make a working drawing that includes multiview drawing, dimensioning, pictorials, and sectional drawing or as many of these areas as possible. Complete student lab projects and assignments. Unit tests		

*Audiovisual aids

UNIT II: FUNCTIONAL DRAFTING 10 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: recognize situations in which functional drafting techniques may be used effectively.	A. Kinds of Functional Drafting 1. In-company or local working drawings 2. for a field of industry or engineering 3. General functional drawing	Read related chapter. Answer study questions. *Take notes	*Discuss functional drafting.	Book 4, pp. 308-319
develop a working knowledge of the use and function of simplified drafting.	B. Simplified Drafting 1. Definition 2. Functionalism 3. Utility	Draw some examples of simplified drafting.	*Give examples of simplified drafting.	Book 4, p. 308, pp. 320-321
	C. Unnecessary Views and Detail 1. Eliminated views 2. Eliminated detail	Draw an illustration of eliminating views and details.	Explain eliminating views and detail.	Book 4, p. 309, pp. 320-321
	D. Other Simplified Techniques 1. Base-line dimensioning 2. No use of arrowheads 3. Templates 4. Time-saving symbols	List some simplified techniques.	Demonstrate some simplified techniques in drafting.	Book 4, p. 311, pp. 320-321
	E. Overlays 1. Composite overlay 2. Pressure-sensitive overlay	List steps in making overlays.		Book 4, pp. 314-317
	F. Tape drafting 1. Opaque 2. Transparent			Book 4, pp. 320-321
		Complete problem(s) assigned by instructor.	Assign problem(s) in class.	
		Unit test		
		*Use your notebook.	*Use charts, overhead projector, and transparencies.	

UNIT III: INKING 5 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: describe the need for, and uses of, inked drawing. make an inked drawing of high quality.	A. Nature and Purpose of Inked Drawings 1. High quality tracings 2. Copying methods	Read chapter on Inking.	Show examples of professionally prepared inked drawings.	Book 4, pp. 276-288 Book 8, pp. 61-63 Book 4, p. 285
	B. Drawing Ink 1. Special characteristics 2. Kinds of ink		Show examples of kinds of inks.	Book 4, pp. 276 277 Book 8, pp. 61-63
	C. Basic Inking Instruments 1. Ruling pens 2. Technical pens a. kinds of points b. advantages		Show examples of inking instruments.	Book 4, pp. 277-279 Book 8, pp. 61-63 Book 8, p. 8
	D. Inking Straight Lines	Observe inking techniques.	*Demonstrate inking techniques.	Book 4, pp. 279-282 Book 8, pp. 61-63
	E. Making Circles and Arcs	Complete problem(s) assigned by instructor.	Have students ink a problem drawn in a previous unit.	Book 4, Fig. 13-44, pp. 286-287
	F. Order of Thinking 1. Arcs 2. Horizontal lines 3. Vertical lines 4. Remaining lines	Unit test	Assist students in completion of problem.	Book 4, Fig. 13-48, p. 288
		*Complete in notebook	*Audiovisual aids	

UNIT IV. SURFACE DEVELOPMENT AND INTERSECTIONS 15 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:		Read related material on surface developments and intersections.	Assign plates where needed.	Book 4, Ch. 18 Book 8, Ch. 13
visualize the surface development of three-dimensional objects.	A. Drafting for Sheet Materials		Present material on surface developments and intersections. Lecture, give examples of visual models	Book 16, Ch. 21 Book 3, pp. 90-101 Book 7, Plate, pp. 88-93 Book 17, pp. 21A-21N
	B. Development of Seams and Laps			Book 4, p. 355 Book 8, p. 359
make accurate surface developments using parallel-line development, radial-line development, and triangulation.	C. Parallel-Line Development 1. Cylinder 2. Two-piece, square, or elbow 3. Four-piece elbow	Make drawings assigned. Make paper models from patterns developed from drawing assignments.	Assign drawing on parallel line development. Assign models that pertain to objects being drawn.	Book 4, p. 357 Book 8, p. 360, pb. 13-1 Book 16, p. 338
	D. Radial-Line Development 1. Cones 2. Pyramids	Make drawing assigned from the area cones and pyramids.	Assign appropriate drawing from raidal-line development.	Book 4, p. 357 Book 16, p. 343
	E. Triangulation	Review triangulation.	Demonstrate triangulation techniques.	Book 4, p. 347, Fig. 18-34 Book 16, p. 349 Fig. 18-35
	F. Intersections 1. Prisms 2. Cylinders 3. Combinations	Observe demonstration of techniques for drawing intersections. Make drawing assigned from chapter on Intersections. Unit test.	Demonstrate techniques used in drawing intersections of prisms, cylinders. Assign drawing on Intersections.	Book 4, pp. 353-356 Book 16, p. 354 Book 4, p. 358 Book 8, pb. 13-10 p. 362. Book 16, p. 361 *Book #3, pp. 95, 97, 101 *Book #7, pp. 90,91, 93 *Book 17, pp. 21-G, 21-K, 21-M
			*Audiovisual - transparencies, overhead projections.	*Suggested plates, Assign where appropriate.

UNIT V: SECONDARY AUXILIARY VIEWS AND REVOLUTIONS 15 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: explain the use of three kinds of auxiliary reference planes. explain how to find the true size of an oblique surface.	A. Auxiliary Projection 1. Kinds of auxiliary views (review) a. front b. top c. right side 2. Auxiliary plane (review) 3. Regular planes (review) 4. Secondary auxiliary showing the true size and shape of a surface	*Notes Review seven steps in preparing a primary auxiliary view by explaining planes. Outline the steps for developing a secondary auxiliary. Draw a secondary auxiliary drawing.	*Explain how inclined surface can be obtained by an auxiliary view. Assign chapter to study. Assign secondary auxiliary drawing(s).	Book 4, pp. 146-149 Book 12, pp. 219-220 Book 16, pp. 257-270 Book 4, p. 147 Book 12, p. 221 Book 3, pp. 237-240
identify the use of the axis of revolution in finding the true shape of an oblique.	B. Axis of Revolution 1. Axis perpendicular to horizontal 2. Axis perpendicular to vertical 3. Axis perpendicular to profile	Evaluate and outline the four most important steps in the development of planes. (Sample - Res. #4, p. 156, fig. 7-25)	Discuss the axis of revolution of work. Apply the two rules of revolution to the movement. Give demonstration of the above.	Book 4, p. 156, Fig. 7-25 Book 12, pp. 231-235 Book 3, p. 239
illustrate the rules of revolution.	C. Rules of Revolution 1. The view that is perpendicular to the axis of revolution stays the same except in position. 2. Distances parallel to the axis of revolution stay the same.	Prepare a drawing of a revolution about an axis perpendicular to the horizontal plane.	Assign a sketch for students to draw.	Book 4, p. 154, Fig.7-20 Book 16, pp. 265-267 Book 12, pp. 231-233 Book 3, p. 243
	D. Kinds of Revolution 1. Single revolution 2. Successive revolutions	Identify the steps in the development of single and successive revolutions. Draw assigned problem. Unit Test	Assign problem(s) on single revolution and successive revolution.	Book 3, pp. 70-74, Auxiliary Book 3, pp. 75-80, Revolutions Book 17, pp. 19A-19J, Revlutions
		*Take notes in notebook.	*Use charts, overhead projector, and transparencies.	

UNIT VI: GRAPHIC CHARTS AND DIAGRAMS 15 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:				
read and interpret basic graphic charts and diagrams.	A. Line Charts 1. Trends or changes 2. Steps in drawing	Read related chapter on Graphic Charts and Diagrams. Review charts and diagrams found in everyday literature.	*Present material on basic graphic charts and diagrams.	Book 4, pp. 463-476 Book 8, pp. 727-744 Book 18, pp. 157-167
	B. Engineering Charts 1. Experimental information 2. Nomographs	*Place examples of charts and graphs in notebook.	Distribute everyday literature to students for reviewing.	Newspapers, magazines, professional journals Book 4, p. 474
	C. Bar Charts 1. Definition 2. Types a. one-column b. two-column c. horizontal-bar d. multiple-bar 3. Steps in drawing		Demonstrate techniques and procedures used for drawing graphic charts and diagrams.	
	D. Pi Charts 1. Definition 2. Steps in drawing			
	E. Pictorial Charts 1. Definition 2. Examples			
	F. Organization and Flow Charts 1. Definition 2. Examples			
construct charts and diagrams.		Make drawings assigned.	Assign drawings on basic charts and diagrams.	Book 4, pp. 475-476 Book 8, p. 739 Book 18, p. 167 *Book 3, p. 143 *Book 9, pp. 126-130
		*Record in notebook.	*Audiovisual; transparencies, overhead projection.	*Worksheet example in appendix

UNIT VII: DETAILED THREAD REPRESENTATION 18 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: demonstrate a knowledge of how to draw screw threads using schematic representation.	A. Schematic Representation (Review)	Copy information in notebook. Read unit in text.	Assign unit in text for reading. Discuss schematic representation screw threads using text and reference materials. *Illustrate schematic representation screw thread on board.	Book 4, p. 210 Book 8, pp. 763-766 Book 12, p. 249 Book 16, pp. 423-425 Book 18, p. 150
demonstrate a knowledge of how to draw screw threads using simplified representation.	B. Simplified Representation (Review)	Copy information in notebook. Read unit in text.	Assign unit in text for reading. Discuss simplified representation screw threads using text and reference materials. *Illustrate simplified representation screw threads on board.	Book 4, p. 210 Book 8, p. 766 Book 12, p. 249 Book 16, pp. 423-425 Book 18, p. 151
make a drawing of screw threads using detailed representation form.	C. Detailed Representation 1. Sharp V 2. Square 3. Acme	Copy information in notebook. Read unit in book.	Assign unit in text for reading. Discuss detailed representation screw threads using text and reference materials. * Illustrate detailed representation screw threads on board showing sharp V, square, and acme.	Book 4, pp. 209-211 Book 8, pp. 762-765 Book 12, pp. 244-247 Book 18, p. 149
		Draw examples of sharp V screw threads, square screw threads, and acme screw threads.	Assign problem to be drawn using sharp V screw threads, square screw threads, and acme screw threads.	Book 4, pp. 223-226 Book 12, pp. 263 & 264 Book 16, pp. 426-434
describe the series, classes of fit, and screw-thread specifications for Unified and American National Standard Screw Threads.	D. Screw Thread Norms 1. Thread series for Unified and American National Standard Screw Threads	Draw a screw thread using an assigned thread note.	Assign a problem giving the students only a thread note. Indicate the kind of head and nut, thread and bolt length.	Book 4, pp. 223-226 Book 12, pp. 263 & 264

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
demonstrate a knowledge of the different kinds of fasteners.	E. Specifying Fasteners 1. Lock nuts 2. Cup screws 3. Machine screws 4. Set screws 5. Wood screws 6. Keys 7. Rivets	Read unit in text. Study examples in text.	*Assign unit in text for reading. Discuss fasteners with students. Illustrate examples on board.	Book 3, pp. 104 & 105 Book 7, pp. 65, 66, 67, 68
		Complete student lab projects and assignments. Unit Test		

*Audiovisual aids

UNIT VIII: MAP DRAFTING 15 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: identify the kinds of maps illustrated.	A. Careers in mapping 1. Civil engineering 2. Draftsman under the supervision of design engineer B. Scales and map sizes 1. Decimals 2. Kilometer 3. Graphic scale	Read chapter on map drafting. Examine techniques for plat of survey, operations map, city map, aerial photo transformed to line drawings, topographic map, geologic map, and structural map.	Assign chapter on map drafting. Read and answer review questions. *Demonstrate techniques used in map drafting.	Book 4, Ch. 22 Book 8, Ch. 21 Book 12, Ch. 21
	C. Contour Maps 1. Lines of constant level 2. Spacing 3. Technical pens 4. Surveying	*Answer review questions.		Book 4, p. 460
	D. Geological mapping 1. Make-up and structure of earth surface and interior depths 2. Geological surface map 3. Geological sections			
make a plat survey or a site plan.		Review city map and oil field operations map.	Assign site plan drawing of teacher's choice. Assist students when needed.	Book 4, pp. 412, 424. 450 Book 4, Fig. 22-24, p. 461 Book 8, p. 605 Book 8, p. 627, plb. 1 Book 12, pp. 395-398 Book 12, p. 398, pbl. 1 & 2
make a contour map, using profile coordinates to show contour profile.		Prepare profile study.	Assign profile coordinate map. Assist students when needed.	Book 4, p. 462, Fig. 22-28 Book 8, p. 627, pbl. 12 Book 12, p. 398, pbl. 3
		Complete student lab projects and assignments. Unit Test		Book 3, pp. 139 & 140 Book 9, pp. 111 & 112
		*Record in Notebooks	*Audiovidual aids. Overlay - projection.	

UNIT IX: BASIC DESCRIPTIVE GEOMETRY 15 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:				Book 4, Ch. 4 Book 4, Ch. 8 Book 12, Ch. 24
graphically define the basic geometric elements and shapes.	A. Points 1. Definition 2. Projections 3. Fixed points	Draw a series of basic geometric shapes and the given basic solids.	Assign drawing problems from the geometric shapes.	Book 15, pp. 289-293 Book 18, Ch. 6 Book 7, pl. 78, 79
		Develop drawings of a line segment.	Assign plate on a line segment.	
make a drawing of the three basic lines, with proper notations.	B. Basic Lines 1. Normal 2. Inclined 3. Oblique	Make a drawing of the three basic lines assigned by the instructor.	Assign drawing covering the basic lines.	Book 4, pp. 166-170 Book 12, pp. 442-443 Book 7, pl. 81
		Develop a drawing on the point view of a line.	Assign plate on the point view of a line.	
make a drawing of an oblique plane and describe principles of geometric location.	C. Planes 1. Plane one (normal) 2. Plane two (inclined) 3. Plane three (oblique)	Make a drawing of an oblique geometric plane, describing the principles of location.	*Give the students a physical model of an oblique plane. Assign drawing covering oblique plane.	Book 4, pp. 168-177 Book 12, pp. 442-443 Book 7, pl. 82-85
		Develop a plate on true shape assigned by instructor.	Assign plate pertaining to the true shape of an object.	*Book 7, pp. 78, 81, 84 Book 17, pp. 20A-20R *Book 17, pp. 20K, 20-O, 20R
		Complete all drawings assigned for this unit.		
		Unit Test		
			*Audiovisual aids	*Sample plates in Appendix

UNIT X: ELECTRICAL AND ELECTRONIC DRAFTING 15 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	A. Career Opportunities 1. Preparation 2. Electrical or electronic draftsman 3. Electronic environment	Read corresponding material in text.	Lecture on career opportunities.	Book 4, pp. 477-479
define the terms used in electrical and electronic drafting.	B. Terms for Understanding Electricity and Electronics 1. Electricity 2. Voltage and current 3. Resistance 4. Units 5. Formulas	Read corresponding material in text.	*Lecture on electrical and electronic drafting.	Book 4, pp. 479-481 Book 8, pp. 549-551
read a graphic symbols chart.	C. Graphic Symbols	Copy graphic symbols into notebook.	Assign graphic symbol chart to be copied in notebook.	Book 2, pg. 470, fig. 23-4 Book 4, pp. 482-483 Book 4, p. 484
list the basic elements of a simple electric circuit.	D. Circuits 1. Series 2. Parallel 3. Combination	Read corresponding material in text.	*Demonstrate the electrical house wiring circuit board.	Book 9, pp. 488-491
		Observe electrical and electronic drawings and identify symbols and types of drawings.	Secure copies of electrical and electronics drawings from local industries and ask class members to identify the symbols and types of drawings.	

*Audiovisual aids

UNIT X: ELECTRICAL AND ELECTRONIC DRAFING (Continued)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
make a drawing of a parallel circuit diagram.	E. Drafting Practices	Draw a parallel-circuit diagram assigned by the instructor.	Assign a problem which will involve the aspects of a parallel-circuit diagram.	Book 4, p. 498
make a drawing of a block diagram.	F. Diagram Procedure 1. Single line 2. Schematic 3. Connection	Draw a block diagram assigned by the instructor.	Assign the students a problem which will emphasize the techniques in drawing a block diagram.	Book 2, pp. 475,489 Book 4, p. 500 Book 8, p. 551 Book 8, pp. 584, pbl. 1 & 2
	G. Printed-Circuit Drawings	Read the section in the text pertaining to printed circuit.	Lecture and show examples of printed circuits.	Book 4, p. 496 Book 8, p. 585, pbl. 10-17
		*Answer review questions at end of chapter.		Book 4, p. 497, 1-6
		Complete all drawings assigned.		Book 3, pp. 132-135 Book 3, pp. 134 & 135 Book 17, pp. 28-A - 28-H Book 17, pp. 28-G & 28-H
		Unit Test		

*Record in notebook.

UNIT XI: TECHNICAL ILLUSTRATION 15 Hours

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:		*Keep notes of discussion.		
identify and select an illustration that provides information by visual methods.	A. Definitions 1. Drawing 2. Information	Define technical illustration. Read chapter.	Assign chapter to read on technical illustration.	Book 4, pp. 523-532 Book 2, pp. 512-521 Book 16, pp. 385-414
	B. Types of Illustration 1. Pictorials 2. Graphic charts 3. Cutaway assembly 4. Exploded assembly 5. Hidden and telltale section 6. Peeled section 7. Film slides and transparencies	List several kinds of illustration Draw assigned problems.	Discuss technical illustration with students. Assign problems for class drawing.	
name some additional drafting instruments, equipment, and supplies. identify proper use of drawing instruments as a means of preparing accurate illustration.	C. Tools, Equipment, and Supplies 1. Crew quill pen 2. Felt-tip pen 3. X-Acto knife 4. Paper Stomp 5. Two brushes 6. Airbrush 7. Reducing glass	Draw assigned problems.	Demonstrate the correct procedure for tool care and identify tools. Assign problems for class drawings.	Book 4, p. 524 Book 2, pp. 519-521
show steps/used in line shading.	D. Line Shading 1. Definition 2. Techniques E. Surface Shading	Draw assigned problems in line shading.	*Show examples of shading object.	Book 2, p. 517
identify and apply various kinds of airbrush renderings.	F. Airbrush Rendering 1. Definition	Prepare a line drawing of assigned objects.	Demonstrate the use of the airbrush.	Book 2, pp. 518-520
		*Take notes in notebook.	*Use transparencies, films, and charts.	

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
	2. Kinds of airbrushes a. oscillating needle b. pencil-type c. poster-type 3. Air supply 4. Procedure for air brushing	Watercolor	Assign problems.	Book 16, pp. 405-408
			Inking (scratchboard)	Book 3, pp. 141 & 142 Book 17, pp. 23A-23L Book 17, pp. 23F, 23J, 23L
		Unit Test		

UNIT XII: ARCHITECTURAL DRAFTING (OPTIONAL)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: identify several styles of residential architecture and define architecture.	A. Styles of Residential Architectural B. Architecture Defined	Read unit in text. Find photographs for and sketch each style of architecture. Write the definition of architecture in your own words.	Discuss the characteristics of each style of architecture and show examples of each. Help students write their own definition of architecture. Define architecture for the class.	Book 4, pp. 378-419 Book 8, pp. 631-663 Book 12, pp. 413-434 Book 16, pp. 533-570 Book 18, pp. 320-343
understand the design function and the fundamentals of the construction of a family dwelling.	C. Architecture Evaluated 1. Show functional pattern 2. Well engineered 3. Aesthetic value	Redesign an existing house room by room. Change existing walls if necessary.	Assign students to redesign an existing house. Remind students to remember traffic patterns from room to room, the structural engineering of the house, and the aesthetic value.	Book 4, pp. 381-383 Book 8, pp. 631-639 Book 12, p. 420 Book 16, pp. 537-546 Book 18, pp. 320-323
make a detailed drawing of a floor plan, related elevation, and exterior wall section.	D. Basic Drawings 1. Plan (floor) 2. Elevation 3. Perspective 4. Wall section	Draw a detailed floor plan; include all necessary information for actual construction. Draw a front and side elevation of the floor plan.	Assign students to make a detailed drawing of a floor plan, front and side elevation, and exterior wall section.	Book 4, pp. 378-429 Book 8, pp. 631-663 Book 12, pp. 413-434 Book 16, pp. 533-570 Book 18, pp. 320-343
		Draw a typical exterior wall section of the floor plan.		Book 3, p. 125 Book 17, pp. 32A-32L Book 17, pp. 32A, 32C, 22I

UNIT XIII: PIPE DRAFTING (OPTIONAL)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:				
demonstrate an understanding of the different types of piping systems and piping materials.	A. Types of Pipe 1. Steel 2. Cast iron 3. Copper 4. Plastic B. Pipe Connections 1. Screwed 2. Flanged 3. Welded 4. Soldered 5. Ball and spigot 6. Cementing C. Pipe Fitting D. Valves 1. Gate 2. Globe 3. Check	Read chapter in text. Study the different kinds of pipe, connections, fittings, and valves. Interpret sample pipe drawing from industry.	Assign students to read chapter in text. Discuss text material and any reference material. Display sample pipe drawings from industry and have students interpret them.	Book 16, pp. 483-485
make accurate drawings of piping systems.	E. Pipe Drawings 1. Single-line orthographic 2. Double-line orthographic 3. Single-line isometric 4. Double-line isometric	Study component chart for single-line and double-line screw connection fitting. Sketch the piping system used in the student's home or classroom. Draw a piping system using all or as many components as you can.	Assign students to study the chart on symbols for screw connection fittings. Assign students to sketch an existing piping system with which they are familiar. Assign students to draw a piping system using all or as many components as possible.	Book 16, pp. 485-490 Book 9, pp. 93-96 Book 17, pp. 29A-29L Book 9, pp. 93 & 96 Book 17, pp. 29A, 29C, 29I

UNIT XIV: AEROSPACE DRAFTING (OPTIONAL)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: list the major aircraft components.	A. Major aircraft components 1. Wings and airfoil 2. The landing gear 3. The power plant	Read related chapter. Make a sketch of major aircraft components and label parts.	*Lecture	Book 4, p. 501 Book 4, pp. 502-506 Book 8, pp. 423-429
list five kinds of aerospace vehicles illustrated in this unit.	B. Aircraft Drafting Practices	Make a sketch of five kinds of aircraft and list their respective physical traits.	Discuss techniques in aerospace drafting.	
list the techniques and advantages of undimensioned aerospace drawing.	C. Undimensioned drawings	Examine the illustrations of undimensioned drawings.	Discuss undimensioned drawings.	Book 4, pp. 506-514 Book 8, pp. 407-408
	D. Typical Drawings	Prepare a list of drawings suitable for undimensioned techniques.		Book 9, pp. 82-86 Book 9, pp. 83 & 85

*Use chart, overhead projector, and transparencies.

UNIT XV: STRUCTURAL DRAFTING (OPTIONAL)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:	A. Types of Work Performed (Structural Draftsman) 1. Detailer in an architect's or engineer's office 2. Making the shop drawing for a construction company 3. Preparing drawings for government or other agencies that regulate the construction and design of public buildings, bridges, and other structures	Read related chapters. Have class discussion. Identify structural drafters.	Lecture. Show students job opportunities. Discuss kinds of structural drafters.	Book 4, p. 430 Book 20, pp. 1-4
identify the various steel shapes employed in structural forms and use proper symbols for each.	B. Structural Steel Shapes 1. American Society for Testing and Material (ASTM) 2. American Institute of Steel Construction (AISC)	Make a drawing of the basic steel shapes and label with proper symbols.	Assign drawings of basic steel shapes.	Book 3, pp. 111-113 Book 21 Book 9, pp. 97-100 *Book 9, pp. 97,100
identify the terms that are common to structural drafting.	C. Vocabulary Words 1. bay 2. beam 3. cantile 4. column 5. flange 6. girder 7. gusset plate	*Notes List some terms that are new to you in drafting.	Discuss new terms with students.	Book 4, pp. 430-444 Book 20, pp. 1-196
		*Take notes in notebook.		*Example in Appendix

UNIT XVI: COMPUTERS IN DESIGN AND DRAFTING (OPTIONAL)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to: understand how digitizers, plotters, and CRT video display units function.	A. Definition of Terms 1. Computer 2. Design drafter 3. Documents 4. Automated design 5. Programmer 6. Program 7. Computer language 8. On-line operation 9. Off-line operation	Record definitions into notebook.	Lecture on computer-related terms. Assign definitions.	Book 2, pp. 427-427 Book 8, pp. 325-328
understand how computers function in computer graphics.	B. Function of Computer-Aided Design in Drafting	Read material in text.	Bring examples of computer aided drawing for class to observe. Take field trip to local industry that uses computer-aided drafting.	Book 2, p. 427 Book 8, pp. 328-329
	C. How the Computer Functions in Computer Graphics	Read related material in text.	Lecture on computer functions	Book 2, pp. 427-428 Book 16, pp. 571-576
	D. Digitizer 1. Manual 2. Mechanized or automated	Read related material in text and view film. Take part in class discussion.	Show a film on computer graphics and lead class in a discussion of the effect of the computer on drafting.	Book 2, p. 429 Book 8, p. 330
demonstrate an understanding of the effects of computers on the drafting profession.	E. Artwork Generators F. Automatic Drafting Machines G. Plotters	Read areas in text. Answer questions for discussion at end of chapter.	Present material to class in form of lecture, handouts, or audiovisual presentations. Assign discussion questions at end of chapter.	Book 2, p. 450 Book 2, p. 430 Book 8, pp. 330-336 Book 2, p. 432
	H. Computer Graphics and the Drafter's future	Complete problems assigned by the instructor.	Assign problems.	Book 2, p. 432 Book 16, pp. 580-584 Book 17, prob. 33A-33D Book 17, pp. 33A, 33C

*Example in appendix

UNIT XVII: WELDING DRAFTING (OPTIONAL)

OBJECTIVES	TOPICS	STUDENT ACTIVITIES	TEACHER ACTIVITIES	RESOURCES
The student should be able to:				
list the basic processes for joining metals and identify the standard symbol for welding.	A. Welding Processes 1. Fusion 2. Gas 3. Arc 4. Thermit 5. Gas and shielded arc 6. Resistance	Read chapter. Draw and label the standard symbols. *List three basic processes of joining metals and give their respective characteristics.	Hold a class discussion on different welding processes. *Show class examples of the different welding processes. *Show film on welding processes.	Book 2, Bh. 24 Book 4, Ch. 17 Book 18, Ch. 14 Book 2, pp. 487-491 Book 4, pp. 323-324 Book 18, pp. 169-171
	B. Welding Drawing Symbols			Book 2, p. 491 Book 4, pp. 325, Fig. 17-8 Book 18, pp. 174-175 Book 2, p. 489 Book 4, p. 325, Fig. 17-8
	C. Welded Joints 1. Butt 2. Lap 3. Corner 4. Edge 5. T	*Make a chart of the kinds of welds and diagram applications, prepare a pictorial drawing illustrating the five welded joints.	Discuss five basic kinds of welded joints.	
make a drawing of a fabricated part assembled with arc welds; use proper symbols.		Make a welding drawing.	Assign a welding drawing.	Book 2, pp. 495-497 Book 4, pp. 331-332 Book 3, pp. 136-138 *Book 3, p. 136
		*Record in notebook.	*Audiovisual aids	*Example in appendix

APPENDIX I

TOOL LIST

ADVANCED TECHNICAL DRAWING

TOOLS AND EQUIPMENT

Classroom tools and equipment provided by the school include the following:

Item	Quantity	Description
Drafting Table	25	30" x 42" w/five storage drawers
Drafting stools	25	Steel frame 30"
Blueprint machine	1	60"
Paper cutter	1	36"
Pencil sharpener	1	General purpose
Supply storage cabinet	1	Metal
Drawing storage cabinet	1	Metal
Teacher desk w/chair	1	Wood
Drawing board	25	18" x 24" wood/metal edge
Drawing paper	200 sheets	8½" x 11" tracing
Drawing paper	200 sheets	11" x 17" white
Drawing paper	100 sheets	18" x 24" tracing
Set of technical pens		
Contour pen		
Airbrush		
Crow quill pens		
Paper stomps		
X-Acto knife		

The following is a list of tools and equipment to be furnished by the student enrolled in the Advanced Technical Drafting course:

Item	Quantity	Description
Set of drawing instruments	1	General purpose
T-square	1	24" plastic
Triangle	1	45° - 10" clear
Triangle	1	30° x 60" - 8" clear
Scale	1	Architect plastic
Erasing shield	1	Metal
Dust brush	1	8" horsehair
Ames Lettering Guide	1	Clear plastic
Protractor	1	General purpose, clear plastic
Irregular	1	8" clear plastic

The following is a list of consumable supplies to be furnished by the student enrolled in the Advanced Technical Drafting course:

Item	Quantity	Description
Drafting tape	1 roll	3/4" - 60 yards
Eraser	1	Plastic
Eraser	1	Art gum
Sandpaper pad	1	
Dusting powder	1	12 oz. bottle
Lead holder	1	.05 MM
Leads	2 ea.	4H, 2H, HB
Illustration board	1	18" x 24" white
Felt tip pen		
Scotch tape		
Masking tape		
3 brushes		

APPENDIX 2

SAFETY

DRAFTING ROOM SAFETY

As it is in industry, safety is a primary concern in the drafting classroom. The most important factor in safety is the attitude of the worker. Before proceeding further, read the following safety precautions pertaining to the use of drafting equipment, machines, and material.

- Adequate clearance around drafting tables must be kept according to fire and safety regulations.
- Stools and chairs must be kept out of aisles and placed under tables and desks when not in use.
- Stools must be used so that they rest on all four legs. A "tilted stool" may cause a serious fall.
- Adjustments to drafting tables should be supervised by the instructor. Fingers must be kept clear of the top and hinged area.
- Drafting machine arms, T-square blades, and other equipment must not block aisles.
- Handle dividers, compass, ruling pen, and pencils carefully as they are sources of puncture wounds.
- Points of thumb tacks often break off from the head and remain sticking out of the drafting board. These points should be removed immediately from the board as they may cause injury to the hands. Tape is recommended for mounting paper on drafting boards.
- Pencils, erasers, and other small articles should be picked up from the floor in order to prevent them from becoming the cause of a serious fall.
- Pencils, thumb tacks, and other small articles should not be placed or held in the mouth. These items may be swallowed or cause injury and infection.
- Chemicals must be kept away from the eyes, nose, and throat; and should be used only in an area where adequate ventilation can be provided.
- Always keep hands and fingers clear of the paper-cutter blade.
- The blade of the paper cutter must be kept in the "down" position when the paper cutter is not in use.
- Hands must be kept clear of the light tube and belt-feeding mechanism of the Diazo whiteprinter in order to avoid crushed fingers.
- Playing, scuffling, and other forms of "horseplay," are extremely dangerous. A playful push may cause a bad cut or bruise from contact with the sharp edge of a piece of furniture or equipment.
- Articles and materials must be stored in proper lockers and shelves. Items placed on top of lockers may fall, causing injuries.
- Any injury, no matter how slight, should be reported to the instructor immediately. Infection can result from uncared for minor cuts and scratches.

INTRODUCTION TO INDUSTRY	NAME	SECTION	DATE	PROBLEM 1-A

ADVANCED TECHNICAL DRAFTING

Suggested Classroom Rules and Regulations Students Should Follow

1. Talking is absolutely forbidden:
    - whenever the teacher is talking.
    - whenever any examination or quiz is in progress.
    - whenever any other student has the floor.
    - whenever there is any kind of audiovisual presentation in progress, such as a film or filmstrip.
2. Do not talk loudly.
3. Do not make disrespectful remarks to the teacher.
4. Do not bring radios, tape players, or other entertainment devices to class.
5. Do not leave paper or trash in the desks or on the floor.
6. Do not mark or otherwise deface school property. This includes desks, floors, walls, chairs, books, etc.
7. Do not move to another seat other than the one assigned to you without prior approval of the teacher.
8. Do not be tardy for class.
9. Do not leave the classroom without a hall pass.
10. Do not congregate in the doorway before or after class.
11. Do not enter the office and storage room, and do not open cabinets without prior permission to do so.
12. Do all work in class under the teacher's supervision. Only supplementary work or drawings may be done outside of class.
13. Complete all makeup work no later than five days after an absence.
14. Do not do work from other classes in the drafting class without special permission.
15. Other than for official meetings, do not leave to go to another teacher's room without a written note from that teacher and approval from the drafting teacher.

16. Use cover sheets for all quizzes and tests.

17. Use five minutes at the end of each hour to clean up and put away equipment and materials. Signal will be given by the teacher for the start of this cleanup.

18. Remain seated at your desk until dismissed by the teacher (not when the bell rings).

19. Be sure that your desk and stool are in order before leaving the class.

20. Enter and exit through the front door only.

ADVANCED TECHNICAL DRAFTING

SUGGESTED STUDENT EXPECTATIONS

I. Students will be expected to bring the following materials to class each day:

1. notebook
2. pencil
3. textbook (when issued)
4. drawing equipment and materials

II. Students will be expected to be in their assigned seats and prepared to begin class when the tardy bell rings.

III. Students will be courteous and respectful to their classmates as well as to the teacher during class activities by listening while others speak.

GRADING CHART FOR TECHNICAL DRAFTING

		Neatness	Accuracy	Line Quality	Lettering
Work is above Criticism in every item	A				
Lacking slightly in not more than one item	B				
Lacking slightly in not more than two items	C				
Lacking seriously in one item or generally lacking	D				
This kind of work should be done over D.O. Grade		Crumpled Inaccurate	Ragged edges Do not roll drawings		Carelessly lettered Omitted drawing guide lines

Other considerations: Industry, speed, judgment, application, general knowledge, consideration of others, and teacher.

Neatness - The absence of undesirable marks from:
1. Measuring
2. Needlepoints
3. Tacking
4. Erasures
5. Finger marks
6. High spot rubs (T-square)
7. Crumpling from rolling
8. Soil or markings in any way

Accuracy - The measure of perfection in:
1. Tangency
2. Measurement
3. Match-line spacing
4. Dimensioning
5. Balancing views
6. Projection
7. Proportion of symbols and other representations

Line Quality - The quality of and conventional correctness of lines:
1. Construction conforming to standards
2. Weight conforming to standards
3. Uniform weight of same class lines
4. Clean cut and not worked over
5. Limitations correct for center lines, extension, and other lines with breaks

Lettering - The quality of the free-hand work on plate:
1. Standard inclination (vertical or incline lettering)
2. Consistent inclination
3. Standard height for purpose
4. Consistent height
5. Guidelines used consistently throughout drawing
6. Lettering composition--correct spacing
7. Work spacing as necessary to drawing
8. Spelling

APPENDIX 3

SUGGESTED PROBLEMS FROM TEXTS

ADVANCED TECHNICAL DRAFTING

Suggested drawing assignments for Advanced Technical Drafting course:

Unit I Review of Basic Technical Drawing

Fig. 15-31 (#12, p. 290)
Fig. 15-35 (#12, p. 292)
Fig. 15-47 (#12, p. 300
Fig. 11-31 (#4, p. 242)
Fig. 11-38 (#4, p. 244)

Unit II Functional Drafting

Fig. 16-29 (#4, p. 320)
Fig. 16-35 (#4, p. 321)
Fig. 16-36 (#4, p. 321)
Fig. 16-37 (#4, p. 321)

Unit III Inking

Fig. 13-38 (#4, p. 286)
Fig. 13-43 (#4, p. 287)
Fig. 13-48 (#4, p. 288)

Unit IV Surface Development and Intersections

Fig. 18-54 (#4, p. 357)
Fig. 18-55 (#4, p. 358)
P. 13-3 (#8, p.360)
P. 13-10 (#8, p. 362)
Fig. 21-41 (#16, p. 358)

Unit V Secondary Auxiliary Views and Revolutions

Fig. 12-35 (#12, p. 227)
Fig. 12-36 (#12, p. 228)
Fig. 12-37 (#12, p. 229)
Fig. 13-10 (#12, p. 236)
Fig. 13-11, (#12, p. 237)
Fig. 7-29 (#4, p. 158)
Fig. 7-59 (#4, p. 160)
Fig. 7-62 (#4, p. 162)
Fig. 7-65 (#4, p. 163)

Unit VI Charts and Diagrams

Fig. 23-46 (#4, p. 475)
Fig. 23-39 (#4, p. 475)
Fig. 23-47 (#4, p. 475)
Fig. 23-56 (#4, p. 476)
Fig. 23-59 (#4, p. 476)

Unit VII **Detailed Thread Representation**

Fig. 24-30 (#16, p. 428)
Fig. 24-43 (#16, p. 434)
Fig. 10-46 (#4, p. 223)
Fig. 10-48 (#4, p. 223)
Fig. 10-52 (#4, p. 224)
Fig. 10-55 (#4, p. 224)
Fig. 14-39 (#12, p. 263)

Unit VIII Map Drafting

Fig. 21-1 (#12, p. 398)
Fig. 21-2 (#12, p. 398)
Fig. 22-27 (#4, p. 461)
Problem 1 (#8, p. 627)
Problem 2 (#8, p. 627)
Problem 13 (#8, p. 627)

Unit IX Basic Descriptive Geometry

Fig. 20-49 (#15, p. 317)
Fig. 20-50 (#15, p. 318)
Fig. 20-54 (#15, p. 322)
Fig. 4-52 (#4, p. 90)
Fig. 4-54 (#4, p. 90)
Fig. 4-61 (#4, p. 90)
Fig. 4-72 (#4, p. 91)
Fig. 8-46 (#4, p. 180)
Fig. 8-50 (#4, p. 180)
Fig. 8-55 (#4, p. 180)

Unit X Electrical and Electronic Drafting

Fig. 24-44 (#4, p. 498)
Problem 2 (#8, p. 584)
Problem 3 (#8, p. 584)

Unit XI Technical Illustration

Fig. 7-40, p. 139 (#2, p. 152)
Fig. 11-63, page 226 (#2, p. 521)
Fig. 18-47, page 372 (#2, p. 521)
Problem 10 (#16, p. 410)
Problem 2 (#16, p. 408)

Unit XII Architectural Drafting

Fig. 20-47 (#4, p. 425)
Fig. 20-99 (#4, p. 425)
Fig. 20-100 (#4, p. 426)
Fig. 22-32 (#8, p. 663, pr. 2)
Fig. 22-40A (#8, p. 662)
Fig. 23-19 (#12, p. 434, pr. 23/9)
Fig. 23-19 (#12, p. 434, pr. 23/11)

Unit XIII Pipe Drafting

Fig. 29-21 (#16, p. 489, pr. 1)
Fig. 29-22 (#16, p. 489, pr. 2)
Fig. 29-24 (#16, p. 490, pr. 4)
Fig. 29-22 (#16, p. 490, pr. 8)
Fig. 29-24 (#16, p. 490, pr. 12)

Unit XIV Aerospace Drafting

Fig. 25-34 (#4, p. 520)
Fig. 25-36 (#4, p. 521)
Fig. 25-37 (#4, p. 522)
Fig. 25-38 (#4, p. 522)
Fig. 16-9 (#8, p. 431, pr. 1)
Fig. 16-49 (#8, p. 432, pr. 18)

Unit XV Structural Drafting

Fig. 21-36 (#4, p. 445)
Fig. 21-37 (#4, p. 445)
Fig. 21-38 (#4, p. 446)
Fig. 21-39 (#4, p. 446)

Unit XVI Computers in Design and Drafting

Fig. 12-17 (#8, p. 335)
Fig. 33-26 (#16, p. 584, pr. 1)
Fig. 33-26 (#16, p. 584, pr. 2)
Fig. 33-26 (#16, p. 584, pr. 3)

Unit XVII Welding Drafting

Fig. 17-26 (#4, p. 331)
Fig. 17-27 (#4, p. 331)
Fig. 17-30 (#4, p. 332)
Fig. 17-32 (#4, p. 332)

APPENDIX 4

SAMPLE WORK SHEETS

All the drafting problems in this section are examples only. They are not to be reproduced, especially those used by permission from the following books:

Brown, Walter. Drafting for Industry Workbook. South Holland, Illinois: Goodheart-Willcox Publishing Company, 1980

Levens, A. S. and Cooper, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.

Spence, William P. Drafting Worksheets. Revised. Peoria, Illinois: Bennett Publishing Company, 1981.

Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

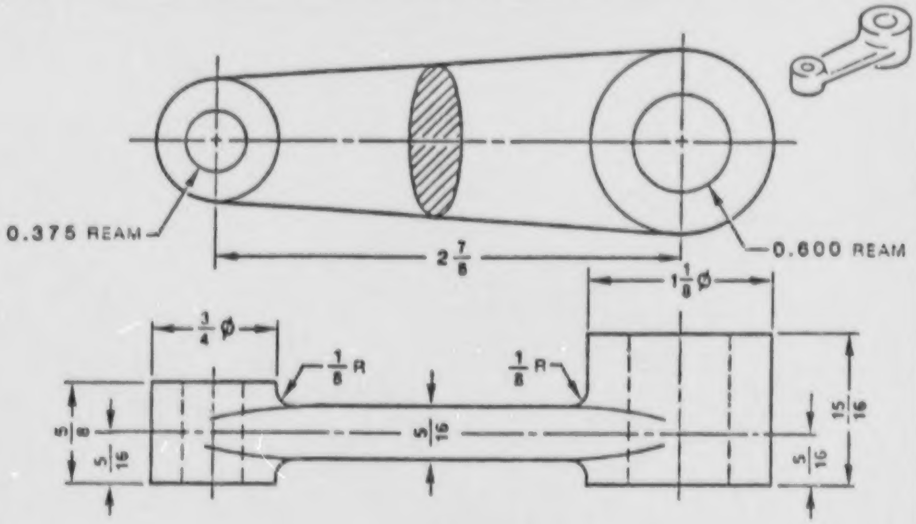
SAMPLE WORK SHEETS

Unit I	Review of Basic Technical Drafting Problems: 30-C, 117, 97
Unit IV	Surface Development and Intersections Problems: 90, 91, 93, 95, 97, 101, 21-G, 21-K, 21-M
Unit V	Secondary Auxiliary Views and Revolutions Problems: 70, 72, 73, 76, 79, 87, 88, 19C, 19E, 19H
Univ VI	Graphic Charts and Diagrams Problems: 126, 127, 128, 129, 130, 143
Unit VII	Detail Thread Representation Problems: 104, 105, 65, 66, 67, 68
Unit VIII	Map Drafting Problems: 111, 112, 139, 140
Unit IX	Basic Descriptive Geometry Problems: 78, 81, 20-K, 20-O, 20-R, 82
Unit X	Electrical and Electronic Drafting Problems: 28-G, 28-H, 134, 135
Unit XI	Technical Illustration Problems: 23-F, 23-J, 23-L, 141, 142

*Optional Areas

*Unit XII	Architectural Drafting Problems: 32-A, 32-C, 32-I, 125
*Unit XIII	Piping Drafting Problems: 29-A, 29-C, 29-I, 93, 96
*Unit XIV	Aerospace Drafting Problems: 83, 85
*Unit XV	Structural Drafting Problems: 97, 100
*Unit XVI	Computer Drafting Problems: 33-A, 33-C
*Unit XVII	Welding Drafting Problem: 136

UNIT I REVIEW OF BASIC TECHNICAL DRAFTING


0.375 REAM
0.600 REAM
2 7/8
1 1/8 Ø
3/4 Ø
1/8 R
1/8 R
5/8
5/16
5/16
15/16
5/16

MAKE A THREE-VIEW WORKING DRAWING.

SCALE 1:1

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Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

DESIGN/WORKING DRAWINGS	NAME	SECTION	DATE	PROBLEM 30-C

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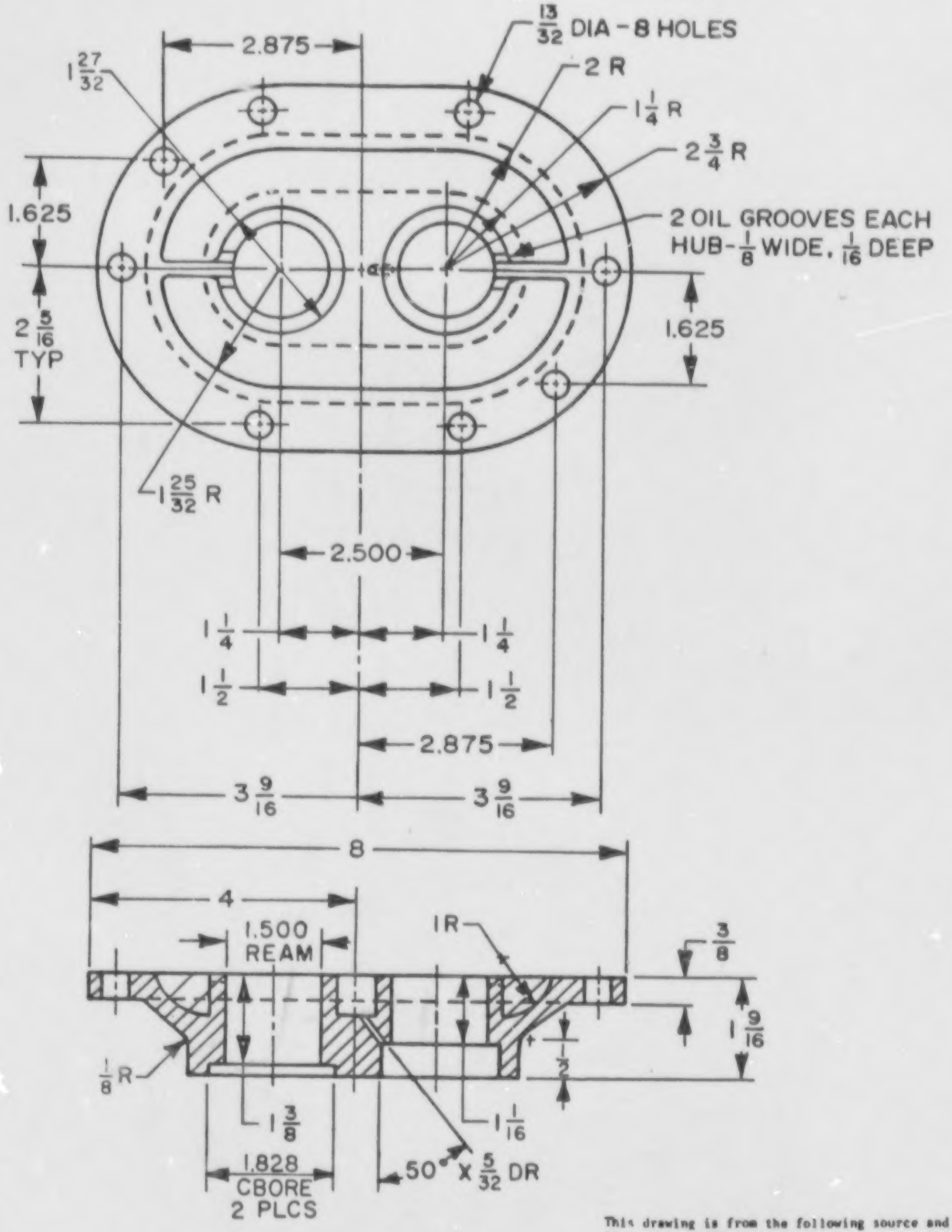
MAKE A DETAILED WORKING DRAWING OF THE PART SHOWN. USE SHEET NO. 115. CHANGE ALL DIMENSIONS TO DECIMAL LIMIT DIMENSIONS WITH THE FOLLOWING TOLERANCES: .XXX = ± .003; .XX = ± .010. DELETE ALL UNNECESSARY DIMENSIONS. INDICATE BY USE OF SYMBOLS ALL FLAT SURFACES AS 125 MICROINCHES AND ALL BORED AND COUNTERBORED HOLES AS 63 MICROINCHES IN TEXTURE.


$\frac{13}{32}$ DIA - 8 HOLES
2.875
$1\frac{27}{32}$
2 R
$1\frac{1}{4}$ R
$2\frac{3}{4}$ R
1.625
2 OIL GROOVES EACH HUB - $\frac{1}{8}$ WIDE, $\frac{1}{16}$ DEEP
$2\frac{5}{16}$ TYP
1.625
$1\frac{25}{32}$ R
2.500
$1\frac{1}{4}$
$1\frac{1}{4}$
$1\frac{1}{2}$
$1\frac{1}{2}$
2.875
$3\frac{9}{16}$
$3\frac{9}{16}$
8
4
1.500 REAM
1 R
$\frac{3}{8}$
$1\frac{9}{16}$
$\frac{1}{8}$ R
$\frac{1}{2}$
$1\frac{3}{8}$
$1\frac{1}{16}$
1.828 CBORE 2 PLCS
50° X $\frac{5}{32}$ DR

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Brown, Walter. Drafting for Industry Workbook. South Holland, Illinois: Goodheart-Willcox Publishing Company, 1980.

GEAR COVER PLATE

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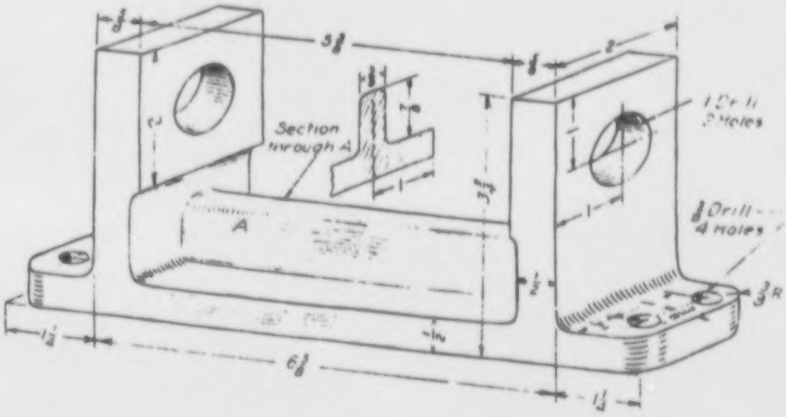
1 Support


5/8
5 3/8
2
5/8
1 Drill
2 Holes
Section through A
1
3 1/4
1
A
3/8 Drill
4 Holes
1/2
3/8 R
1 1/4
6 3/8
1 1/4

Make a working drawing of the *Support*. Dimension completely and indicate the surfaces you assume to be finished. Show a revolved or removed section of the web. Suggested scale: ½ size. (Millimeters may be used, with a scale of 1:2.)

2 Clamp

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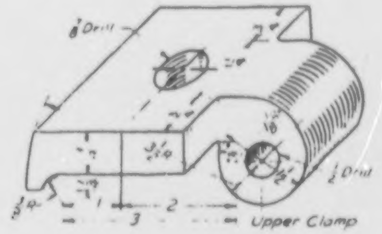
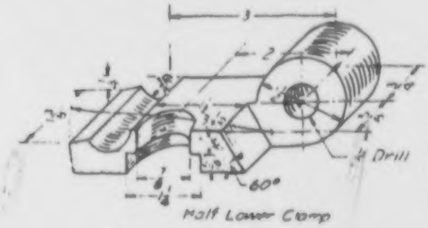
Levens, A. S. and Cooper, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.

a.


Drill
2
1/2 Drill
1
2
3
Upper Clamp

b.


3
2
Drill
60°
Half Lower Clamp

Make full-size working drawings of the two parts of the *Clamp*.

Draw an assembly of the *Clamp* (open at 45°) with sections as deemed necessary.

NAME OF SCHOOL

Drawn by: ____________

Date: ____________

97

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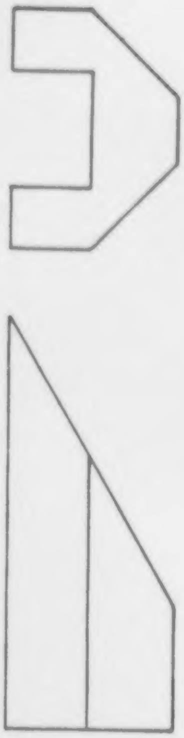
UNIT IV SURFACE DEVELOPMENT AND INTERSECTIONS



1. **Using instruments, draw the right-side and auxiliary views to show the true shape of the sloping surface. (Refer to Chapter 7.)**

2. Draw an auxiliary view, showing the true shape of the sloping surface. Use the offset method in drawing the curve. (Refer to Chapter 7.)

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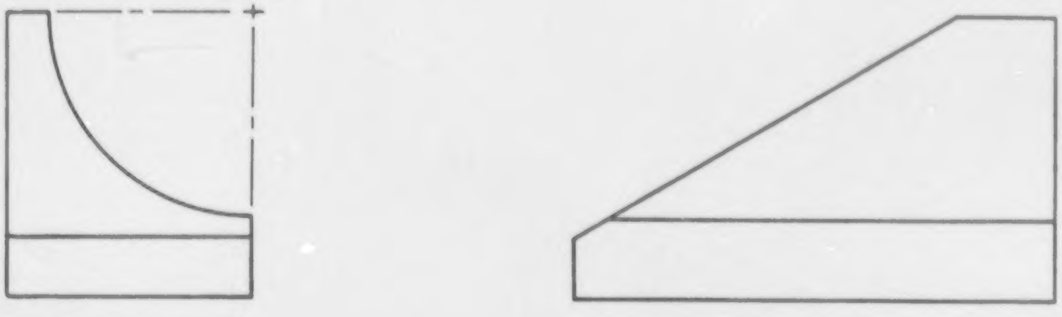
Levens, A. S. and Cooper, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.



Title: *Auxiliary Views*

NAME OF SCHOOL

Drawn by: ____________________
Date: ____________________

90

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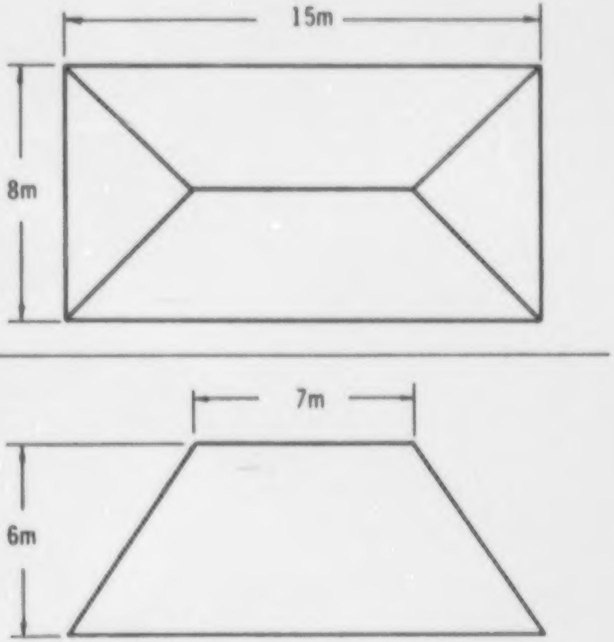
Make a pattern (development) of the roof surfaces and calculate the number of square meters in the entire roof.



Title: *Development*

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Levens, A. S. and Cooper, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.

NAME OF SCHOOL

Drawn by
Date

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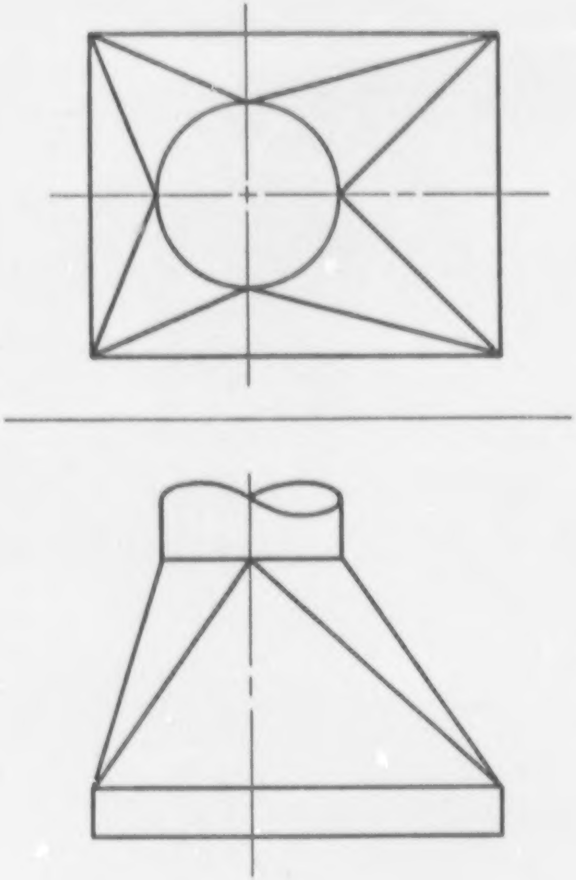
Develop the lateral surface of the *Transition Piece* that connects the circular duct and the rectangular opening.



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Levens, A. S. and Cooper, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.

Title: *Development*

NAME OF SCHOOL		Drawn by Date	93

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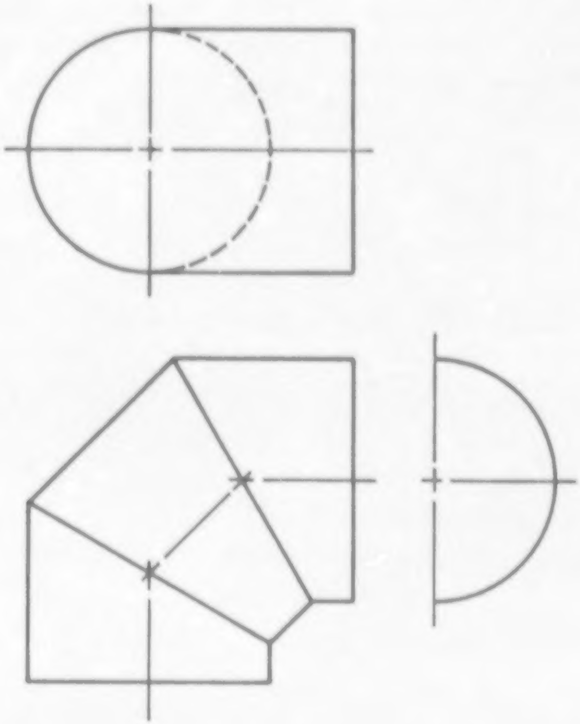
LAY OUT THE INSIDE PATTERN FOR THE DEVELOPMENT OF THE PIPE ELBOW. TITLE: THREE-PIECE ELBOW.



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Brown, Walter. Drafting for Industry Workbook.
South Holland, Illinois: Goodheart-Willcox
Publishing Company, 1980.

NO. 95

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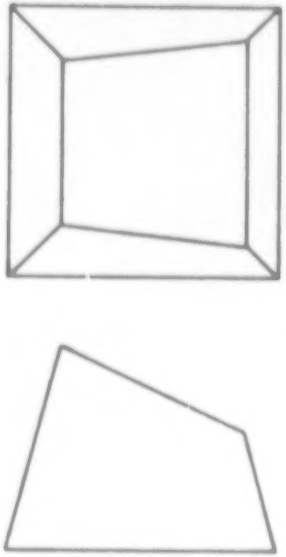
LAY OUT THE INSIDE PATTERN FOR THE PYRAMID. TITLE: TRUNCATED PYRAMID.



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Brown, Walter. *Drafting for Industry Workbook*.
South Holland, Illinois: Goodheart-Willcox
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NO. 97

97

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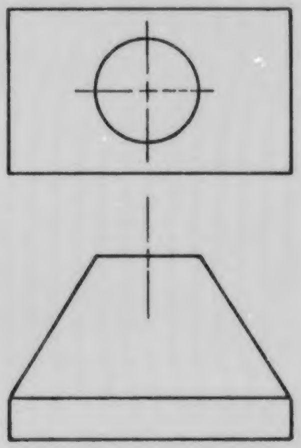
LAY OUT THE INSIDE PATTERN FOR THE TRANSITION PIECE. TITLE: TRANSITION PIECE.



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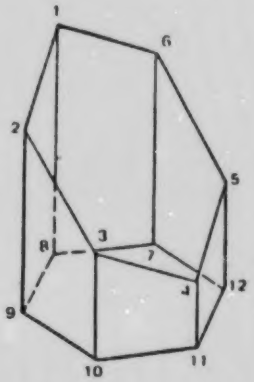
NAME

SECTION

DATE

PROBLEM 21-G

COMPLETE THE PATTERN DEVELOPMENT.


1
6
2
5
3
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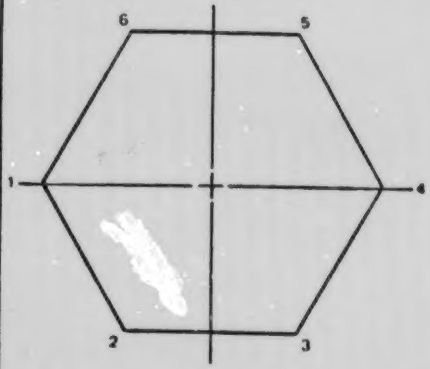
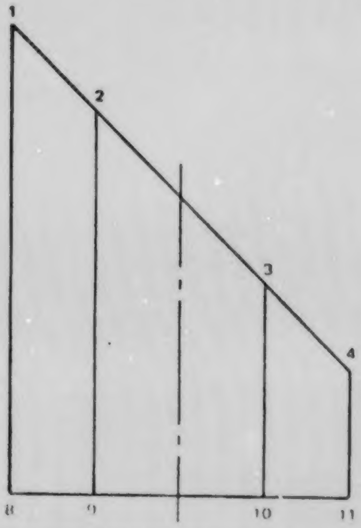
7
4
12
9
10
11




1
2
3
4
8
9
10
11

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Kallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

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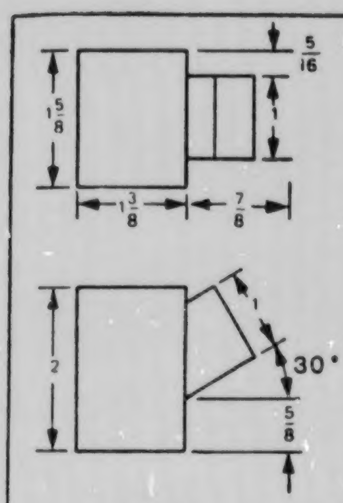

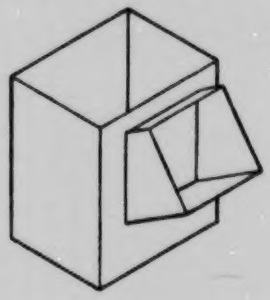

COMPLETE THE PATTERN DEVELOPMENT.

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Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

DEVELOPMENTS	NAME	SECTION	DATE	PROBLEM 21-K

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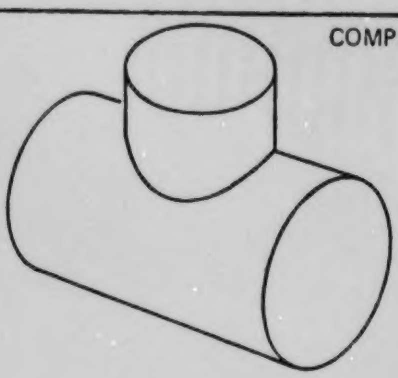
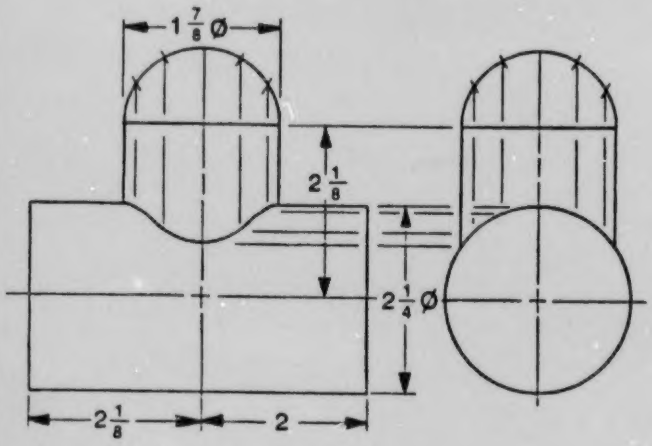


COMPLETE THE PATTERN DEVELOPMENT.



SCALE 1 2

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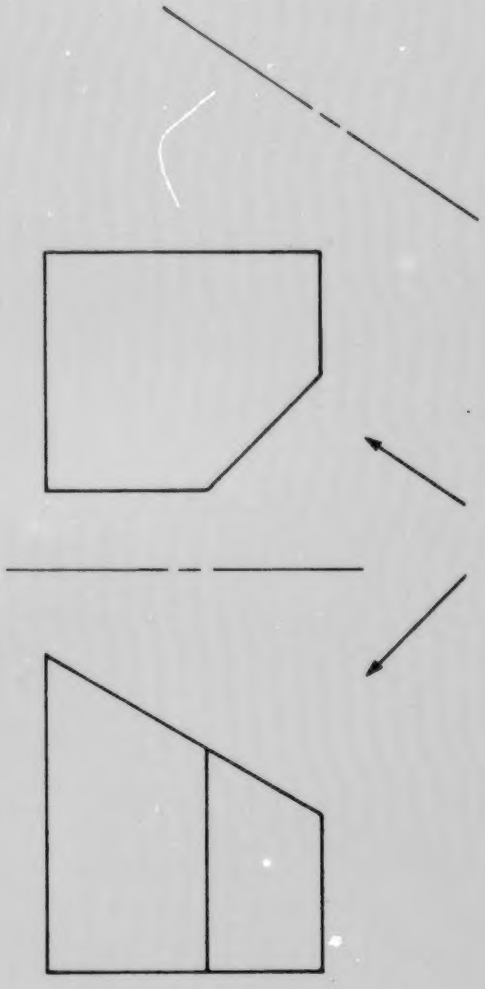
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1961.

DEVELOPMENTS	NAME	SECTION	DATE	PROBLEM 21-M

UNIT V SECONDARY AUXILIARY VIEWS AND REVOLUTIONS

CONSTRUCT A SECONDARY AUXILIARY VIEW OF THE OBJECT AS INDICATED. LEAVE CONSTRUCTION LINES TO SHOW CONSTRUCTION

TITLE: SECONDARY AUXILIARY.



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NO. 70

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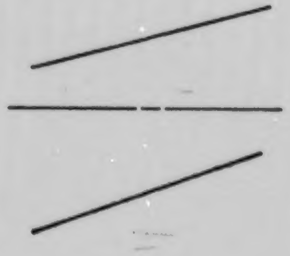
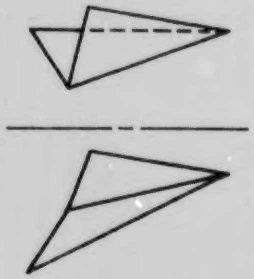
DO THE SECONDARY AUXILIARY PROJECTIONS AS INDICATED. TITLE: SECONDARY AUXILIARY PROJECTIONS.



FIND THE POINT VIEW OF THE LINE



FIND THE TRUE ANGLE BETWEEN THE OBLIQUE PLANES

69

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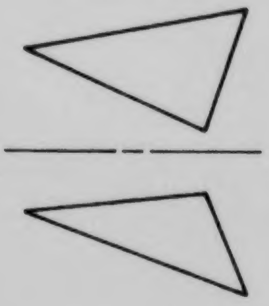
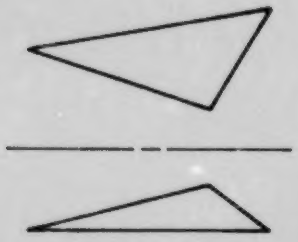


CONSTRUCT THE TRUE SIZE AND SHAPE OF THE OBLIQUE SURFACE



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Brown, Walter. Drafting for Industry Workbook.
South Holland, Illinois: Goodheart-Willcox
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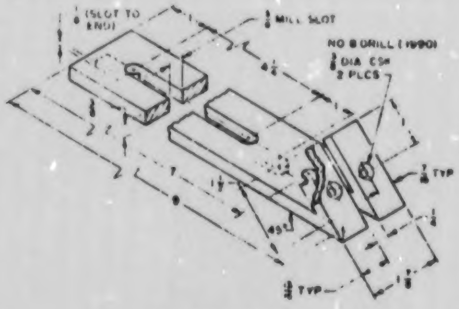
CONSTRUCT THE TRUE SIZE AND SHAPE OF THE OBLIQUE SURFACE

72

NO. 72

DRAW THE NECESSARY VIEWS INCLUDING AN AUXILIARY VIEW OF THE INCLINED SURFACE.


(SLOT TO END)
MILL SLOT
NO 8 DRILL (.1990)
DIA CSK
2 PLCS
4 1/4
TYP
45°
2
7
9
1 1/2
TYP

STRIPPER BRACKET

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70

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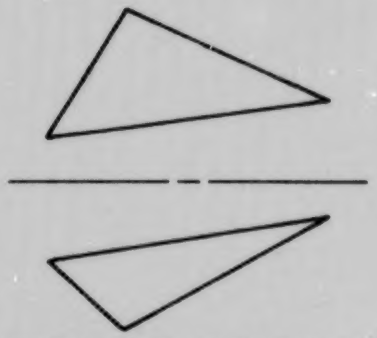
73

NO. 73

USE THE REVOLUTION METHOD FOR SOLVING THE PROBLEMS AS INDICATED. TITLE: REVOLUTIONS.



A FIND TRUE SIZE OF THE PLANE BY PROJECTING AN EDGE VIEW IN HORIZONTAL AUXILIARY AND BY REVOLUTION.

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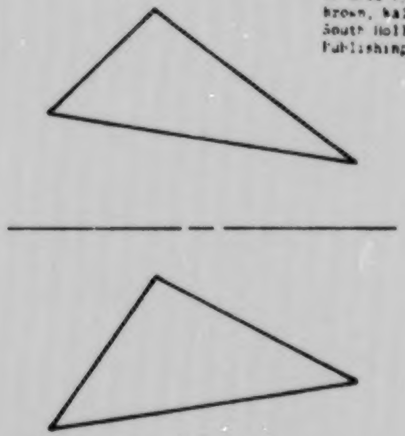
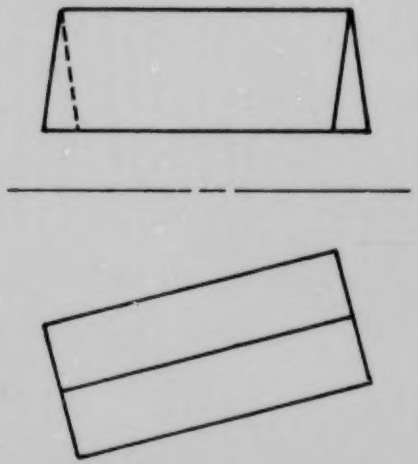
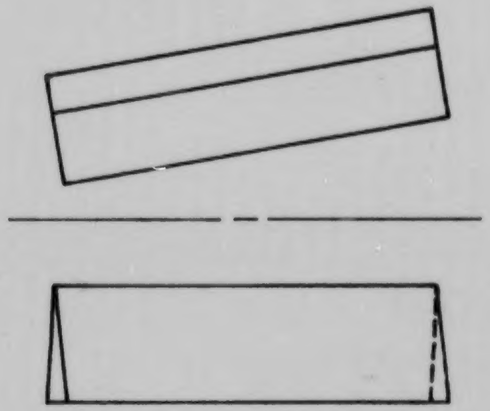
Brown, Walter. Drafting for Industry Workbook. South Holland, Illinois: Goodheart-Willcox Publishing Company, 1980.



B FIND TRUE SIZE OF THE PLANE BY A PRIMARY AUXILIARY AND BY REVOLUTION.



C FIND TRUE SIZE OF THE ANGLE BETWEEN THE INTERSECTING PLANES.



D FIND TRUE SIZE OF THE ANGLE BETWEEN THE INTERSECTING PLANES.

71

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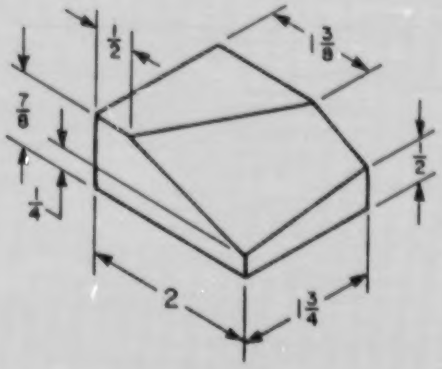
76

NO. 76

DRAW A SUCCESSIVE REVOLUTION OF THE OBJECT TO PRODUCE A TRUE SIZE VIEW OF THE OBLIQUE SURFACE. TITLE: SUCCESSIVE REVOLUTIONS.



A

B

NORMAL POSITION.

C

REVOLVE ON AXIS OF HORIZONTAL PLANE.

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Brown, Walter. Drafting for Industry Workbook.
South Holland, Illinois: Goodheart-Willcox
Publishing Company, 1980.

D REVOLVE ON AXIS OF FRONTAL PLANE. INDICATE THE TRUE SIZE SURFACE.

NO. 79

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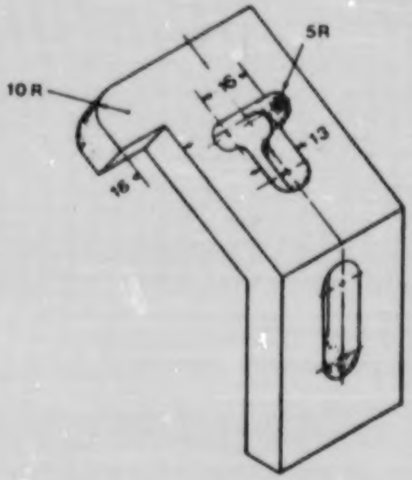

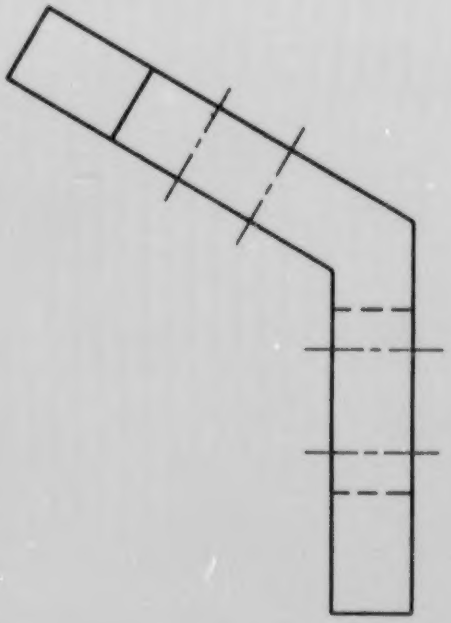

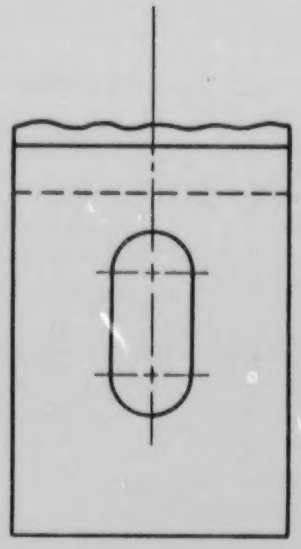

Draw a partial auxiliary view to show the true shape of the sloping surface of the *Angle Stop*. Complete the front view to show the hidden lines.

This drawing is from the following source and is used by permission.
Levens, A. S. and Cooner, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.

Title: ***Angle Stop***

NAME OF SCHOOL

Drawn by
Date

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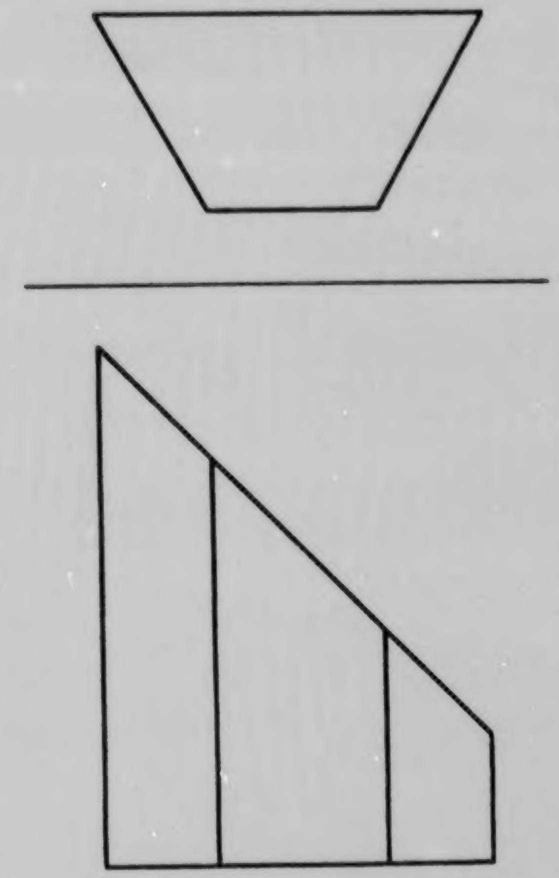
Develop the lateral surface of the Truncated Prism. (Refer to Chapter 18 in the text.)

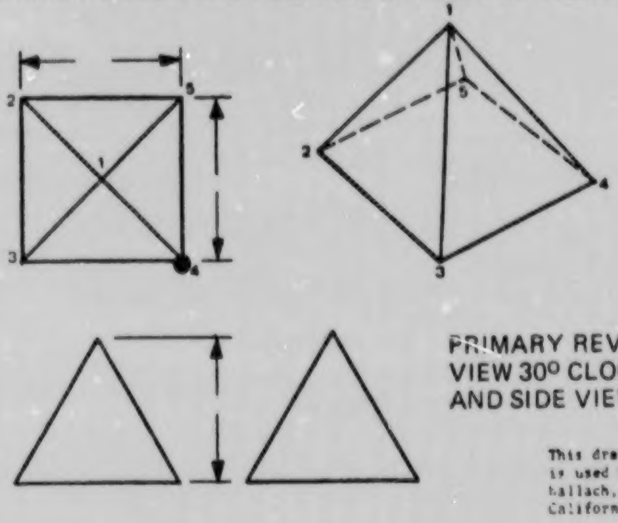


This drawing is from the following source and is used by permission.
Levens, A. S. and Cooper, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.

Title: *Development*

NAME OF SCHOOL		Drawn by: ______ Date: ______	88

ADD DIMENSIONS AND NUMBER EACH CORNER OF ALL THE VIEWS.



PRIMARY REVOLUTION – REVOLVE TOP VIEW 30° CLOCKWISE. COMPLETE FRONT AND SIDE VIEW.

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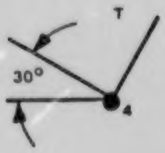
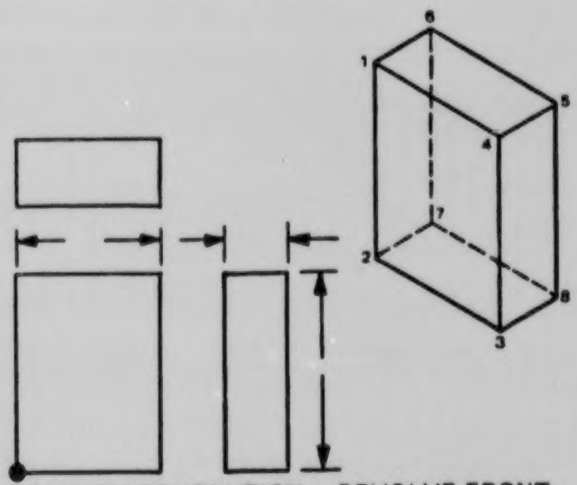
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.



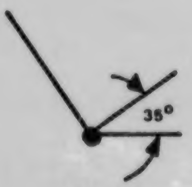
F

S

SCALE 1:1



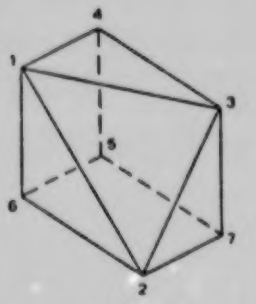
PRIMARY REVOLUTION – REVOLVE FRONT VIEW 35° COUNTER CLOCKWISE. COMPLETE TOP AND SIDE VIEW.

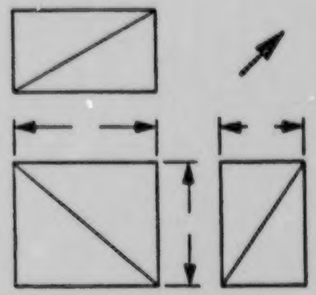


SCALE 1:1

REVOLUTIONS	NAME	SECTION	DATE	PROBLEM 19-C

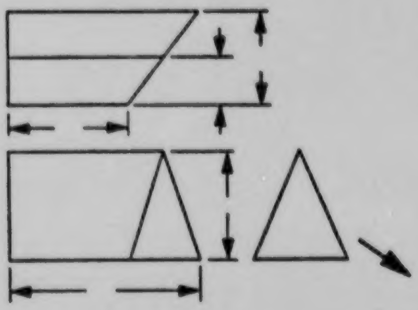
REVOLVE SURFACE 1, 2, 3, TO TRUE SIZE USING AUXILIARY OR REVOLUTION TECHNIQUES.





SCALE 1:2

REVOLVE SURFACE 1, 2, 3, TO TRUE SIZE.



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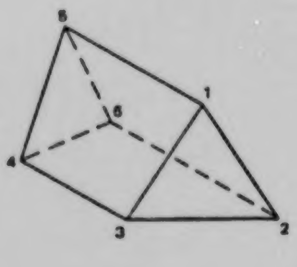
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.



SCALE 1:2

REVOLUTIONS	NAME	SECTION	DATE	PROBLEM 19-E

REVOLUTIONS

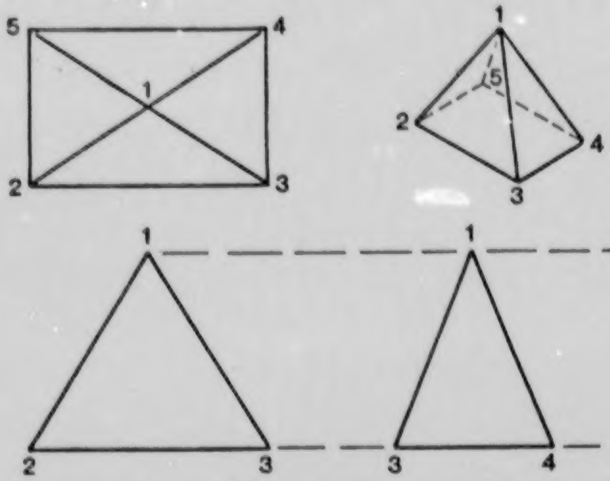
NAME

SECTION

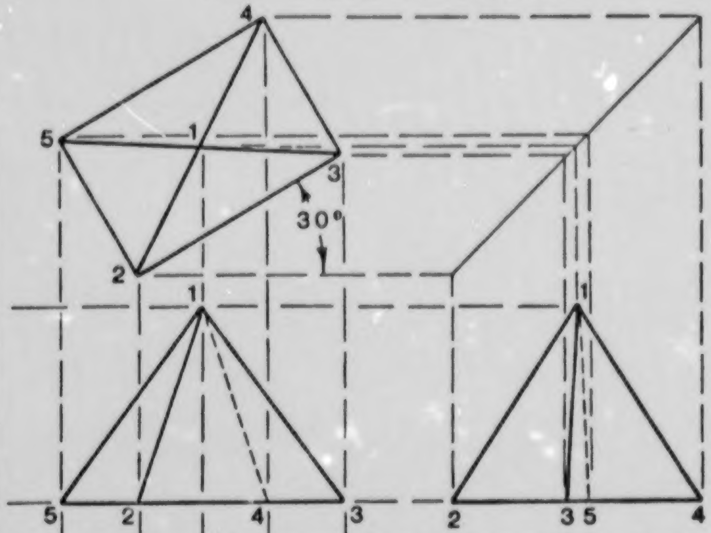
DATE

PROBLEM 19-H

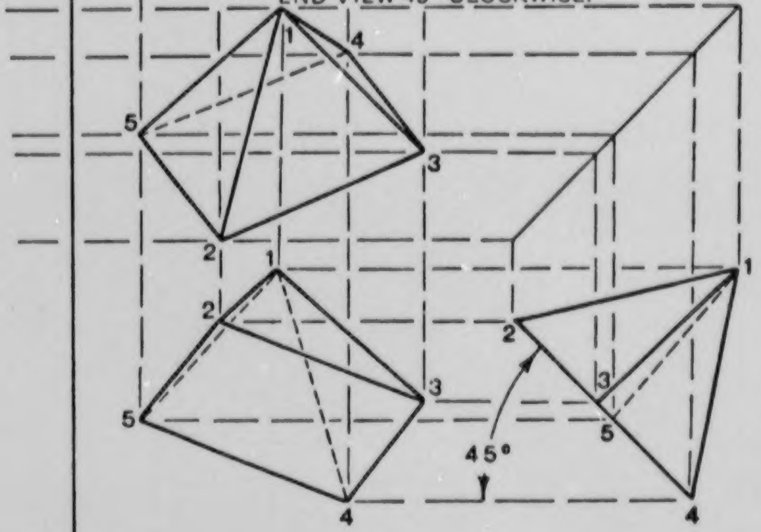
ORTHOGRAPHIC – ISOMETRIC


5
4
1
2
3
1
5
2
4
3
1
1
2
3
3
4

STEP 1. PRIMARY REVOLUTION – REVOLVE TOP VIEW 30° COUNTER CLOCKWISE.


4
5
1
3
30°
2
1
1
5
2
4
3
2
3 5
4

STEP 2. SUCCESSIVE REVOLUTION – REVOLVE END VIEW 45° CLOCKWISE.


1
4
5
3
2
1
2
3
5
4
1
2
3
5
45°
4

STEP 3. COMPLETE SUCCESSIVE REVOLUTION – REVOLVE FRONT VIEW 30° CLOCKWISE.

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UNIT VI GRAPHIC CHARTS AND DIAGRAMS

MAKE A MULTIPLE LINE CHART TO COMPARE THESE DATA.
USE LINE SYMBOLS OR COLOR.

INTERNATIONAL TOURIST ARRIVALS				
REGION	1975	1976	1977	1978
GERMANY, W.	7,231,315	7,889,614	8,422,520	8,663,048
FRANCE	24,931,000	25,036,000	26,265,000	27,137,000
ROMANIA	3,205,926	3,168,710	3,684,854	3,791,452
MALTA	315,417	339,537	361,874	477,741

MAKE A PIE CHART SHOWING LIVESTOCK PRODUCTION IN ITALY

ANIMAL	NUMBER
CATTLE	8,568,000
SHEEP	8,694,000
GOATS	960,000
PIGS	9,420,000
HORSES	523,000

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Spence, William P. *Drafting Worksheets*. Revised. Peoria, Illinois: Bennett Publishing Company, 1981.

MULTIPLE LINE CHART

PIE CHART

CHARTS		126

DRAW A BAR CHART SHOWING THESE DATA, USING COLOR TO INCREASE THE EFFECTIVENESS OF THE CHART.

TELEPHONES IN SERVICE

AUSTRALIA	5,267,000	WEST GERMANY	19,603,000
BRAZIL	3,371,000	JAPAN	45,515,000
CANADA	13,885,000	U.S.S.R.	16,949,000
FINLAND	1,833,993	UNITED STATES	149,012,000
FRANCE	13,833,000	UNITED KINGDOM	21,244,000

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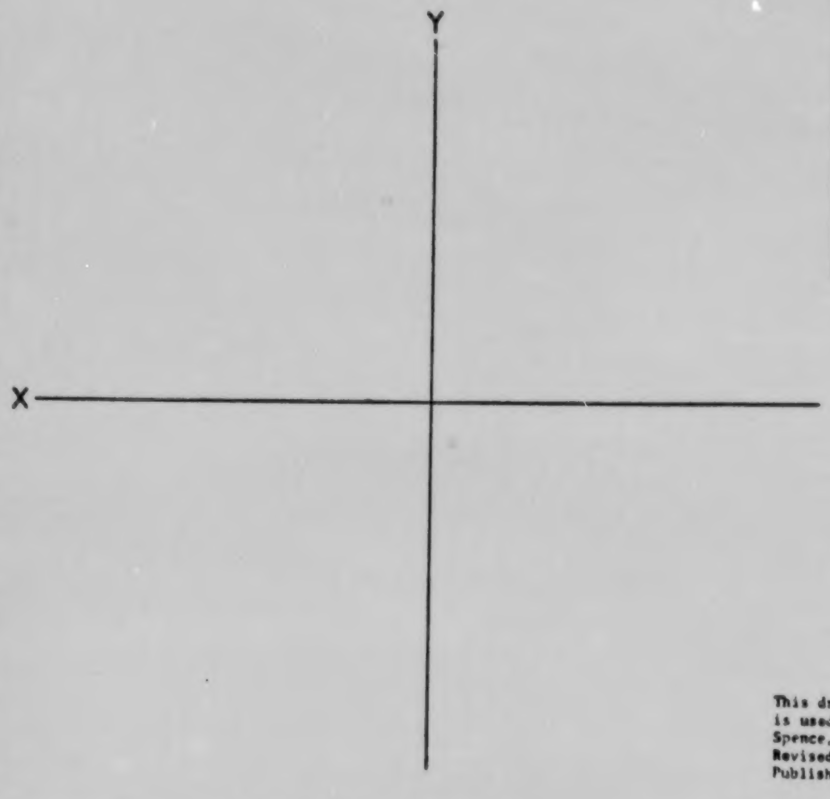
Spence, William P. Drafting Worksheets. Revised. Peoria, Illinois: Bennett Publishing Company, 1981.

MAKE A HIGH-LOW BAR CHART OF THESE STOCK PRICES:

STOCK PRICES IN DOLLARS		
COMPANY	LOW	HIGH
APEX STEEL	3.75	5.92
FOOD INC.	7.63	9.75
RAPID TRANSIT	1.72	3.51
COMPUTERS INC.	5.87	9.89

POINTS ON A CURVE X=Y		
POINT	X	Y
1	-5.	+5.
2	-4.0	+3.0
3	-3.0	+1.8
4	-1.5	+0.75
5	0	0
6	+1.5	-0.75
7	+3.0	-1.8
8	+4.0	-3.0
9	+5.0	-5.0



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Spence, William P. Drafting Worksheets. Revised. Peoria, Illinois: Bennett Publishing Company, 1981.

CHARTS		128

MAKE A SURFACE CHART. USE COLOR.

IMPORTS AND EXPORTS OF STEEL MILL PRODUCTS*

	1960	1961	1962	1963	1964	1965	1966	1967	1968
IMPORTS	3.2	3.0	4.1	5.3	6.2	10.3	10.5	11.2	18.0
EXPORTS	2.9	2.0	2.0	2.2	3.1	2.5	1.5	1.7	2.1

* MILLIONS OF TONS

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Spence, William P. Drafting Worksheets.
Revised. Peoria, Illinois: Bennett
Publishing Company, 1981.

CHARTS 129

FOLLOWING ARE SOME DATA TO BE SHOWN BY A CHART. DECIDE WHICH TYPE OF CHART WILL BEST SHOW THE DATA. DRAW THE ASSIGNED PROBLEMS ON SHEET 131.

VOLTAGES PRODUCED BY DIFFERENT SOURCES	
SOURCE	VOLTAGE RANGE
BATTERIES	6-12
AUTOMOBILE GENERATORS	6-12
TRAIN GENERATORS	32-60
RESIDENTIAL TRANSFORMERS	120-440
CITY DISTRIBUTION TRANSFORMERS	2,300-4,200
POWER TRANSMISSION LINES	13,200-287,500

WORLD PRODUCTION OF TIN IN METRIC TONS	
MALAYSIA	75,000
BOLIVIA	30,000
THAILAND	22,000
CHINA	20,000
U.S.S.R.	28,000
INDONESIA	20,000
NIGERIA	9,000

YEARLY FINANCIAL REPORTS *				
ACCOUNTS	JAN-MAR	APR-JUN	JUL-SEP	OCT-DEC
PAID	10.2	7.5	9.5	13.8
DELINQUENT	1.5	5.7	4.2	0.9

* THOUSANDS OF DOLLARS

COMPOSITION OF GERMAN SILVER	
COPPER	50%
NICKEL	20%
ZINC	30%

TEN LARGEST NATIONS BY POPULATION	
CHINA	852,000,000
INDIA	610,000,000
U.S.S.R.	257,000,000
UNITED STATES	215,000,000
INDONESIA	140,000,000
JAPAN	113,000,000
BRAZIL	109,000,000
NIGERIA	85,000,000
BANGLADESH	79,000,000
PAKISTAN	72,000,000

ASSETS OF NONFINANCIAL CORPORATIONS	
YEAR	MILLIONS OF DOLLARS
1972	573.5
1973	643.3
1974	712.2
1975	731.6
1976	753.5
1977	779.2
1978	799.1
1979	805.6

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Spence, William P. *Drafting Worksheets*. Revised. Peoria, Illinois: Bennett Publishing Company, 1961.

CHARTS		130

PREPARE A LINE GRAPH CONTRASTING THE NUMBER OF PERSONS EMPLOYED IN SERVICE-PRODUCING INDUSTRIES WITH THOSE IN GOODS-PRODUCING. USE THE FOLLOWING DATA. SUBSTITUTE ACTUAL DATES FOR YEARS.

MILLIONS OF WORKERS		PAST		PRESENT	FUTURE	
		10 YRS	5 YRS		5 YRS	10 YRS
	SERVICE	24.8	27.2	34.0	47.6	59.7
	GOODS	27.3	26.0	24.8	28.5	30.0

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Brown, Walter. Drafting for Industry Workbook. South Holland, Illinois: Goodheart-Willcox Publishing Company, 1980.

NO. 135

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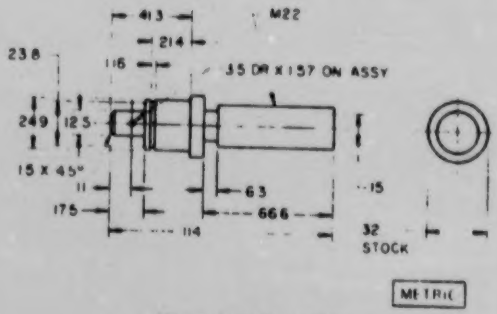
UNIT VII DETAILED THREAD REPRESENTATION

DRAW THE REQUIRED VIEWS TO ADEQUATELY DESCRIBE THE SPINDLE RAM SCREW. SHOW A DETAIL REPRESENTATION OF THE THREAD BY DRAWING TWO FULL THREADS ON EACH END OF THREADED PORTION AND INDICATE THE REMAINDER BY USE OF PHANTOM LINES AT THE MAJOR DIAMETER. DIMENSION THE PART.


41.3
M22
21.4
23.8
11.6
3.5 DR X 15.7 ON ASSY
24.9
12.5
1.5 X 45°
11
6.3
15
17.5
66.6
114
32
STOCK
METRIC

SPINDLE RAM SCREW

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Brown, Walter. Drafting for Industry Workbook.
South Holland, Illinois: Goodheart-Willcox Publishing Company, 1980.

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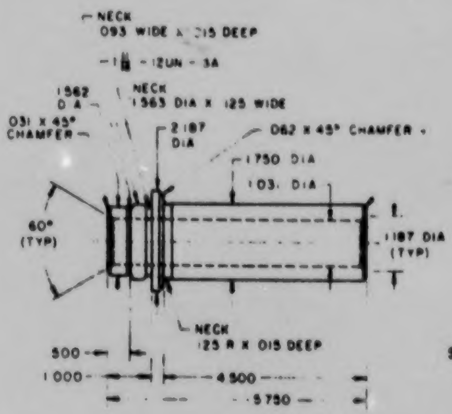
NO. 104

DRAW A HALF SECTION OF THE SHANK AND SHOW THE THREADS IN SCHEMATIC FORM. DIMENSION THE PART.


NECK
.093 WIDE x .015 DEEP
1$\frac{9}{16}$ - 12UN - 3A
1.562 DIA
NECK
1.563 DIA x .125 WIDE
.031 x 45° CHAMFER
2.187 DIA
.062 x 45° CHAMFER
1.750 DIA
1.031 DIA
60° (TYP)
1.187 DIA (TYP)
NECK
.125 R x .015 DEEP
.500
1.000
4.500
5.750

SHANK

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Brown, Walter. Drafting for Industry Workbook.
South Holland, Illinois: Goodheart-Willcox
Publishing Company, 1980.

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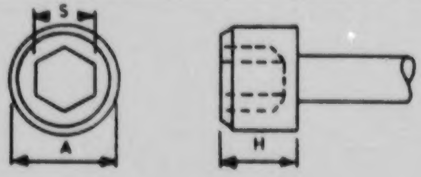
NO. 105

PREFERRED SERIES OF FASTENER SIZES, THREAD PITCHES AND THEIR THREAD TENSILE STRESS AREAS

Nominal Dia and Thread Pitch	Tensile Stress Area mm²	Nominal Dia. and Thread Pitch	Tensile Stress Area mm²
M1.6 × 0.35	1.27	M20 × 2.5	245
M2 × 0.4	2.07	M24 × 3	353
M2.5 × 0.45	3.39	M30 × 3.5	561
M3 × 0.5	5.03	M36 × 4	817
M3.5 × 0.6	6.78	M42 × 4.5	1120
M4 × 0.7	8.78	M48 5	1470
M5 × 0.8	14.2	M56 × 5.5	2030
M6 × 1	20.1	M64 × 6	2680
M8 × 1.25	36.6	M70 × 6	3460
M10 × 1.5	58.0	M80 × 6	4340
M12 × 1.75	84.3	M90 × 6	5590
M14 × 2	115	M100 × 6	6990
M16 × 2	157		

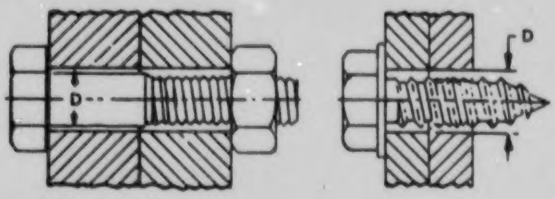
DIMENSIONS OF HEX SOCKET CAP SCREWS

Nom. Screw Dia. and Thread Pitch	A	H	S
	Head Dia. max.	Head Height max.	Hex Socket Size nom.
M1.6 × 0.35	3.0	1.6	1.5
M2 × 0.4	3.8	2.0	1.5
M2.5 × 0.45	4.5	2.5	2.0
M3 × 0.5	5.5	3.0	2.5
M4 × 0.7	7.0	4.0	3.0
M5 × 0.8	8.5	5.0	4.0
M6 × 1	10.0	6.0	5.0
M8 × 1.25	13.0	8.0	6.0
M10 × 1.5	16.0	10.0	8.0
M12 × 1.75	18.0	12.0	10.0
M14 × 2	21.0	14.0	12.0
M16 × 2	24.0	16.0	14.0
M20 × 2.5	30.0	20.0	17.0
M24 × 3	36.0	24.0	19.0
M30 × 3.5	45.0	30.0	22.0
M36 × 4	54.0	36.0	27.0

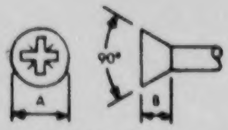


CLEARANCE HOLES FOR THREADED FASTENERS

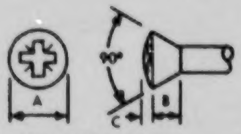
Bolts, Screws and Studs				Tapping Screws (AB, B, BF, BT)	
Nom. Fastener Size	Hole Clearance D Basic	Nom. Fastener Size	Hole Clearance D Basic	Nom. Screw Size	Hole Clearance D Basic
M1.6 × 0.35	1.8	M20 × 2.5	22.0	2.2	2.6
M2 × 0.4	2.4	M24 × 3	26.0	2.9	3.3
M2.5 × 0.45	2.9	M30 × 3.5	33.0	3.5	4.0
M3 × 0.5	3.4	M36 × 4	39.0	4.2	4.8
M3.5 × 0.6	4.0	M42 × 4.5	45.0	4.8	5.4
M4 × 0.7	4.5	M48 × 5	52.0	5.5	6.2
M5 × 0.8	5.5	M56 × 5.5	62.0	6.3	7.1
M6 × 1	6.6	M64 6	70.0	8.0	9.0
M8 × 1.25	9.0	M72 × 6	78.0	9.5	10.5
M10 × 1.5	11.0	M80 × 6	86.0		
M12 × 1.75	13.5	M90 × 6	96.0		
M14 × 2	15.5	M100 × 6	107.0		
M16 × 2	17.5				



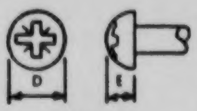
DIMENSIONS OF MACHINE AND TAPPING SCREW HEADS



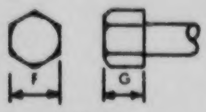
FLAT COUNTERSUNK HEAD



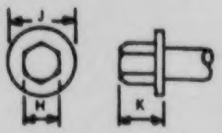
OVAL COUNTERSUNK HEAD



PAN HEAD



HEX HEAD



HEX WASHER HEAD

NOM. THREAD SIZE		A	B	C	D	E	F	G	H	J	K
Machine Screws and Tapping Screws	Tapping Screws (Thread Types AB, B, BF, BT.)	Head Dia. Max.	Head Height Approx.	Raised Head Height Approx.	Head Dia. Max.	Head Height Max.	Width Across Flats	Head Height	Width Across Flats	Washer Dia.	Head Height
2	2.2	4.4	1.2	0.5	3.9	1.6	3.2	1.6	3.0	4.2	2.0
2.5	—	5.5	1.5	0.6	4.9	1.9	4.0	2.1	3.2	5.3	2.9
3	2.9	6.3	1.6	0.8	5.8	2.3	5.0	2.3	4.0	6.3	3.7
3.5	3.5	8.2	2.4	0.9	6.8	2.5	5.5	2.6	5.0	7.3	4.1
4	4.2	9.3	2.7	1.0	7.8	2.8	7.0	3.0	5.5	8.4	4.5
5	4.8	10.3	2.7	1.2	9.8	3.5	8.0	3.8	6.0	10.5	5.4
—	5.5	11.5	3.0	1.4	10.7	3.8	8.0	3.9	7.0	11.6	6.0
6	6.3	12.6	3.3	1.5	12.0	4.3	10.0	4.7	8.0	12.9	6.6
8	8	17.2	4.6	2.0	15.6	5.6	13.0	6.0	10.0	16.8	8.1
10	9.5	20.0	5.0	2.5	19.5	7.0	16.0	7.5	13.0	21.0	9.2

NAME OF SCHOOL	SPECIFICATIONS FOR METRIC FASTENERS	Drawn by: ____________ Date: ____________	65

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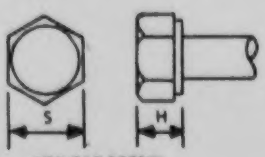
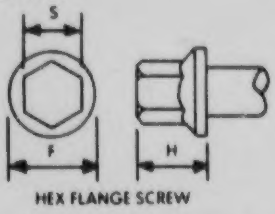
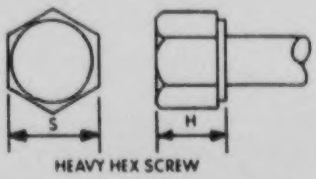
DIMENSIONS OF HEX HEAD SCREWS



HEX CAP SCREW



HEX FLANGE SCREW



HEAVY HEX SCREW

Nom. Dia and Thread Pitch	Hex Cap Screws		Hex Flange Screws			Heavy Hex Screws	
	S	H	S	H	F	S	H
	Width Across Flats	Head Height Max.	Width Across Flats	Head Height Max.	Flange Diameter Max.	Width Across Flats	Head Height Max.
M5 × 0.8	8.0	3.7	7.0	5.4	11.8	—	—
M6 × 1	10.0	4.2	8.0	6.6	14.2	—	—
M8 × 1.25	13.0	5.5	10.0	8.1	18.0	—	—
M10 × 1.5	16.0	6.6	13.0	9.2	22.3	—	—
M12 × 1.75	18.0	7.8	15.0	11.5	26.6	21.0	7.8
M14 × 2	21.0	9.1	18.0	12.8	30.5	24.0	9.1
M16 × 2	24.0	10.3	21.0	14.4	35.0	27.0	10.3
M20 × 2.5	30.0	12.9	27.0	17.1	43.0	34.0	12.9
M24 × 3	36.0	15.4	—	—	—	41.0	15.4
M30 × 3.5	46.0	19.5	—	—	—	50.0	19.5
M36 × 4	55.0	23.4	—	—	—	60.0	23.4

NOTE

1 Screws are not standard for sizes without dimensions.
2 Formed hex screws and hex bolts have essentially the same basic head dimensions as hex cap screws.
3 Heavy hex bolts and high strength structural bolts have essentially the same head dimensions as **heavy hex screws**.

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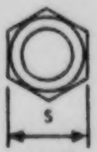
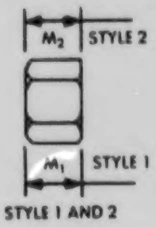
Levens, A. S. and Cooper, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.

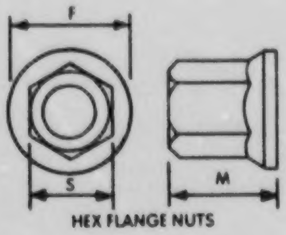
DIMENSIONS OF HEX NUTS



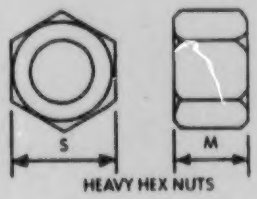
HEX NUTS



STYLE 1 AND 2



HEX FLANGE NUTS



HEAVY HEX NUTS

Nom. Dia. and Thread Pitch	Hex Nuts, Styles 1 & 2			Hex Flange Nuts			Heavy Hex Nuts	
	S	M1	M2	S	M	F	S	M
	Width Across Flats	Nut Thickness Max. Style 1	Nut Thickness Max. Style 2	Width Across Flats	Nut Thickness Max.	Flange Diameter Max.	Width Across Flats	Nut Thickness Max.
M5 × 0.8	8.0	4.7	5.1	8.0	5.0	11.8	—	—
M6 × 1	10.0	5.2	5.7	10.00	5.7	14.2	—	—
M8 × 1.25	13.0	6.8	7.5	13.0	7.5	18.0	—	—
M10 × 1.5	16.0	8.4	9.3	15.0	10.0	22.3	—	—
M12 × 1.75	18.0	10.8	12.0	18.0	12.0	26.6	21.0	12.3
M14 × 2	21.0	12.8	14.1	21.0	14.0	30.5	24.0	14.3
M16 × 2	24.0	14.8	16.4	24.0	16.0	35.0	27.0	17.1
M20 × 2.5	30.0	18.0	20.3	30.0	20.0	43.0	34.0	20.7
M24 × 3	36.0	21.5	23.9	—	—	—	41.0	24.2
M30 × 3.5	46.0	25.6	28.6	—	—	—	50.0	30.7
M36 × 4	55.0	31.0	34.7	—	—	—	60.0	36.6

NOTE

Steel hex style 1 nuts are availabe only in property classes 5 and 10, hex style 2 nuts in classes 9 and 12, hex flange nuts in classes 9 and 10, and heavy hex nuts in classes 8S, 83, 10S and 103. Nuts are not standard for sizes without dimensions.

NAME OF SCHOOL	SPECIFICATIONS FOR METRIC FASTENERS	Drawn by ______ Date ______	66

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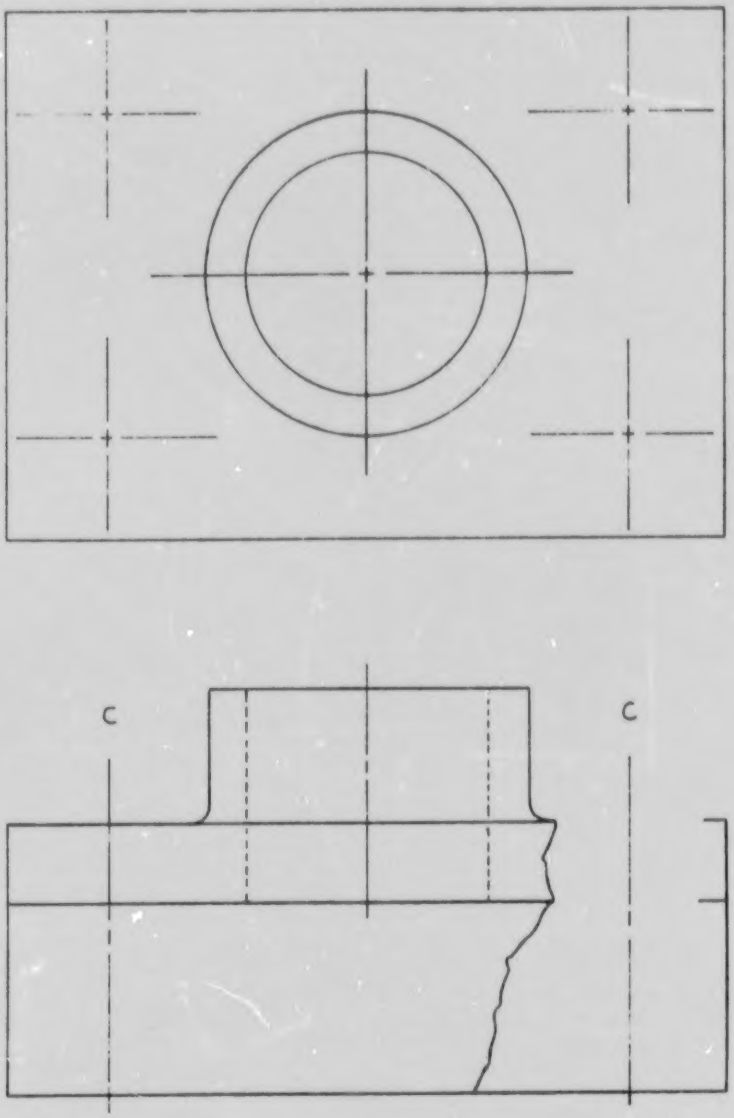
Draw 10-mm hex-head cap screws on centerlines C. Show screws on front view across corners. The holes in the lower piece are to be bottom-tapped to a 19-mm depth. Show the right-hand side of the front view as a broken-out section. Complete the top view. Refer to the previous two plates.

Hexagon-head cap screw specifications:
Length (front under head): 28.5 mm
Thread Length: 2D − 6 mm



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Levens, A. S. and Cooper, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.

Title: *Threaded Fasteners*

______________________ NAME OF SCHOOL		Drawn by ______________ Date ______________	67

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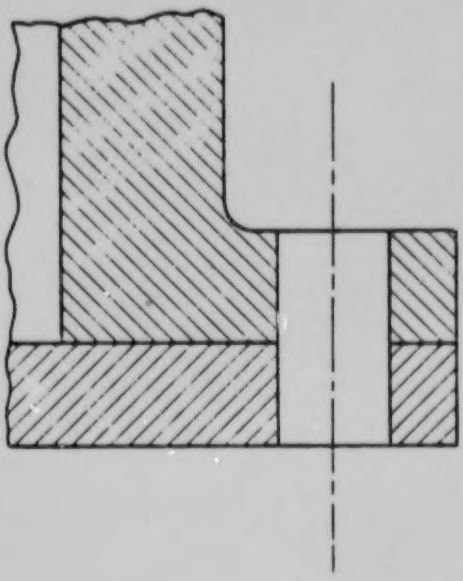
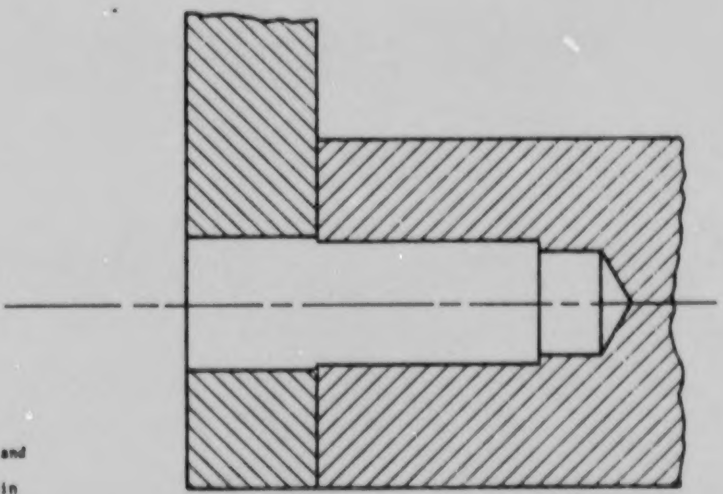
1. Shown below is a head plate and flange. Draw a 16-mm hex-head bolt and nut on the centerline. Place the bolthead above and draw across corners. Show the nut across flats.



Specifications:
Bolt length: 50 mm
Thread length: 2D - 6 mm

2. Draw a 19.0-mm hexagonal-head cap screw. Show the head across corners.

Specifications:
Screw length: 50 mm
Thread length: 2D - 6 mm



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Title: *Threaded Fasteners*

NAME OF SCHOOL
Drawn by
Date
68

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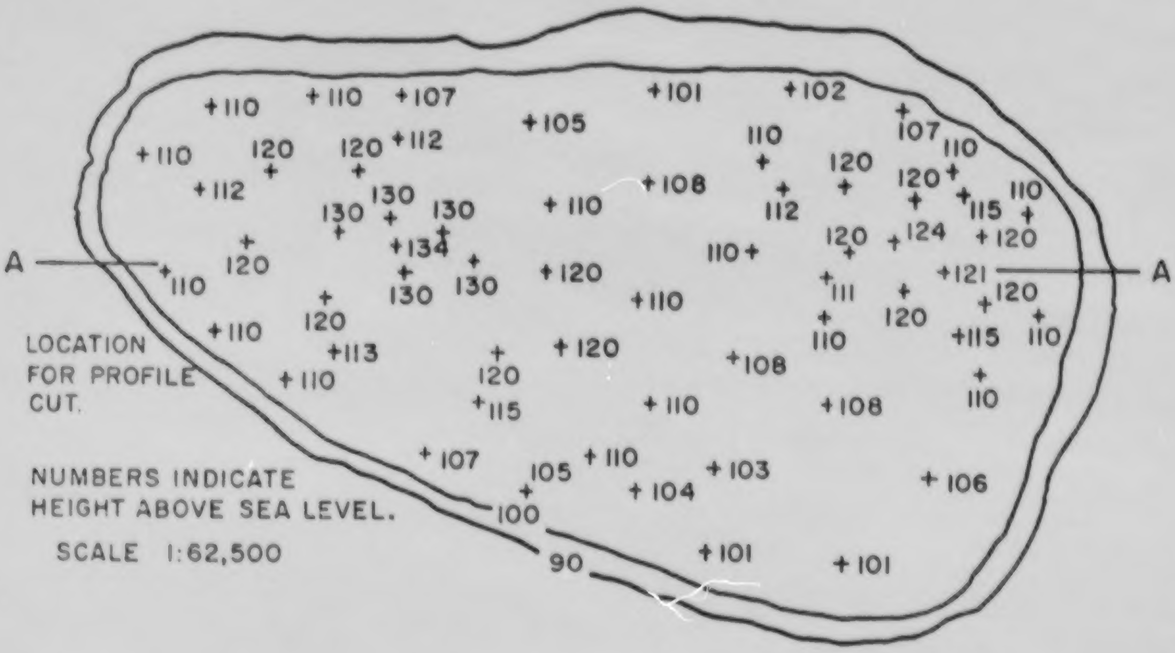
UNIT VIII MAP DRAFTING

DRAW A CONTOUR MAP OF THE AREA BELOW. DRAW ON TOP OF THIS PRINTED LAYOUT. THE CONTOUR INTERVAL IS 10'-0".


+110
+110
+107
+105
+101
+102
+107
+110
120
120
+112
110
120
110
120
+112
+108
+110
112
130
130
130
115
+110
120
+134
110+
120
124
+120
A
110
130
130
+120
+111
+121
120
A
+110
120
+110
120
110
110
+113
+120
+108
+115
+110
120
+115
+110
+108
110
+107
105
+110
+103
+106
100
+104
90
+101
+101

LOCATION FOR PROFILE CUT.

NUMBERS INDICATE HEIGHT ABOVE SEA LEVEL.

SCALE 1:62,500

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Spence, William P. Drafting Worksheets. Revised. Peoria, Illinois: Bennett Publishing Company, 1981.

A A

PROFILE DRAWING BASE

DRAW A PROFILE THROUGH THE ABOVE AREA AT THE INDICATED SECTION. SELECT A SCALE THAT CLEARLY SHOWS THE PROFILE.

MAPPING		111

MAPPING

94

MAKE A PLOT OF THE SURVEYOR'S DATA BELOW.
USE SCALE - 1" = 100'. START WITH POINT 1.

	BEARING	DISTANCE
POINT 1 TO 2	NORTH	575'
POINT 2 TO 3	N 45° - 0' E	175'
POINT 3 TO 4	S 70° - 0' E	625'
POINT 4 TO 5	S 30° - 0' E	350'
POINT 5 TO 6	S 25° - 0' W	250'
POINT 6 TO 1	N 85° - 0' W	775'

POINT 1

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Spence, William P. *Drafting Worksheets*. Revised. Peoria, Illinois: Bennett Publishing Company, 1981.

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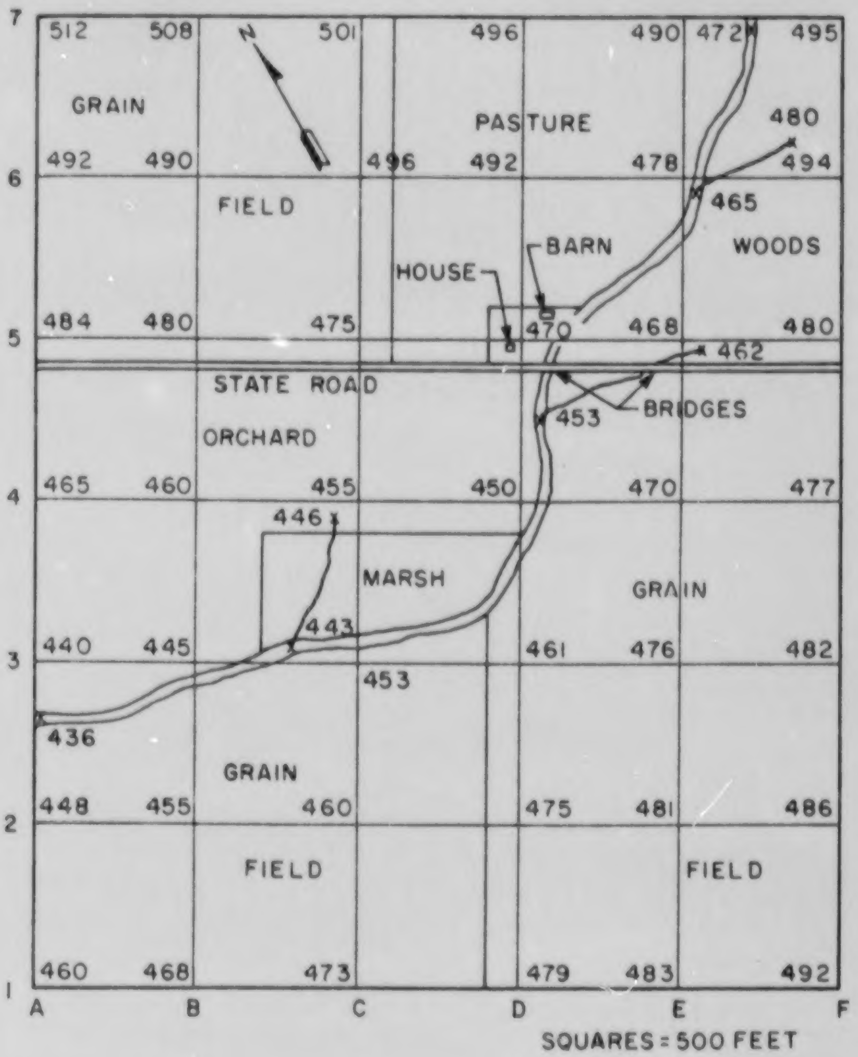
112

SELECT AN APPROPRIATE CONTOUR INTERVAL AND PLOT THE CONTOURS, AND NATURAL AND MAN-MADE FEATURES FOR THE MAP SHOWN. IN THE SPACE BELOW THE CONTOURED MAP DRAW A PROFILE MAP AT LINE 3. EXAGGERATE THE SCALE TO EMPHASIZE CHANGES IN ELEVATION. TITLE — TOPOGRAPHIC MAP WITH PROFILE.


7
512
508
N
501
496
490
472
495
GRAIN
PASTURE
480
492
490
496
492
478
494
6
FIELD
465
BARN
WOODS
HOUSE
484
480
475
470
468
480
5
462
STATE ROAD
BRIDGES
453
ORCHARD
465
460
455
450
470
477
4
446
MARSH
GRAIN
443
440
445
461
476
482
3
453
436
GRAIN
448
455
460
475
481
486
2
FIELD
FIELD
460
468
473
479
483
492
1
A
B
C
D
E
F
SQUARES = 500 FEET

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Brown, Walter. Drafting for Industry Workbook. South Holland, Illinois: Goodheart-Willcox Publishing Company, 1980.

NO. 131

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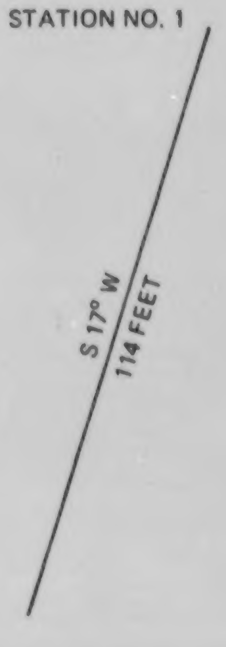
COMPLETE THE MAP TRAVERSE BY PLOTTING THE DATA FOR STATIONS 2 AND 3. STATION NO. 2 RIGHT-DEFLECTION ANGLE = 75° DISTANCE FROM NO. 1 = 129 FEET. STATION NO. 3: RIGHT-DEFLECTION ANGLE = 138° 30'; DISTANCE FROM NO. 2 = 162.5 FEET CLOSE THE TRAVERSE AND INDICATE THE DIRECTION AND DISTANCE. SCALE : 1" = 30'.



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Brown, Walter. *Drafting for Industry Workbook.* South Holland, Illinois. Goodheart-Willcox Publishing Company, 1960.

NO. 132

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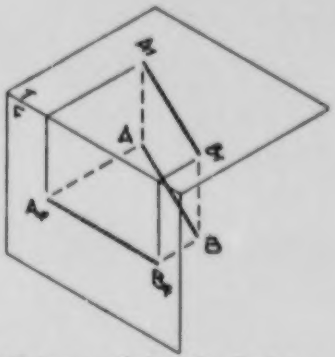
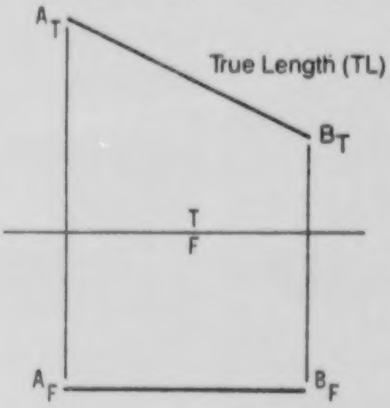
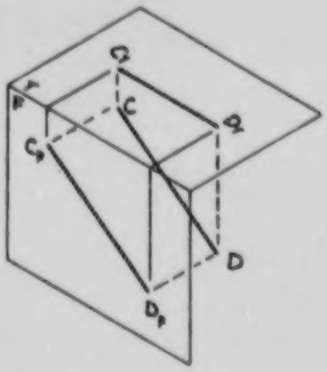
UNIT IX BASIC DESCRIPTIVE GEOMETRY

The true length of a line segment may be seen on a plane that is parallel to the line segment. Study the examples below, and refer to Chapter 8 in the text. T = Top; F = Front.

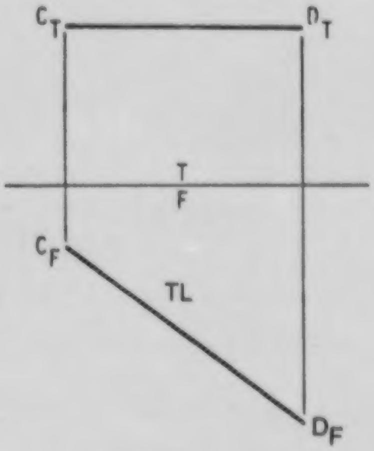


Line AB is parallel to the T-plane.

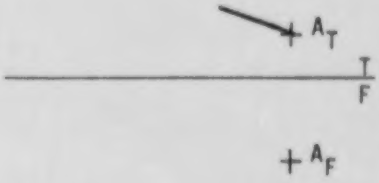




Line CD is parallel to the F-plane.

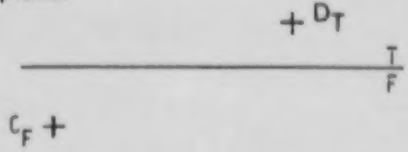


1. Line AB is parallel to the T-plane and is 40 mm long. Complete the two views of the line.



Title: *TL of Line Segment*

2. Line CD is parallel to the F-plane and is 50 mm long. Complete the two views of the line. Point D is below the T-plane.



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NAME OF SCHOOL

Drawn by: ________
Date: ________

78

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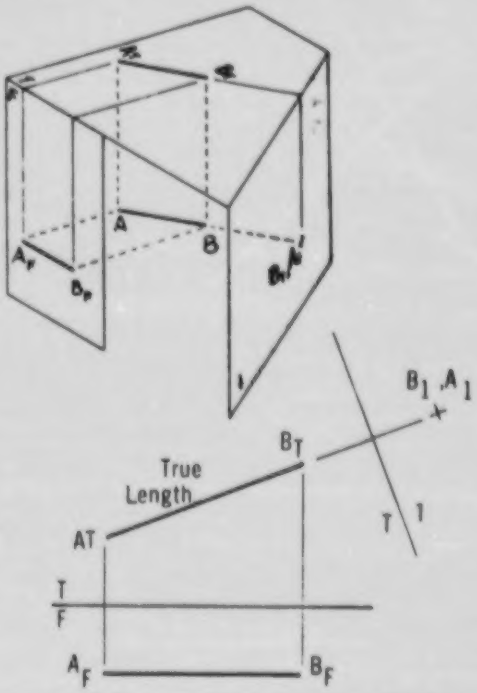
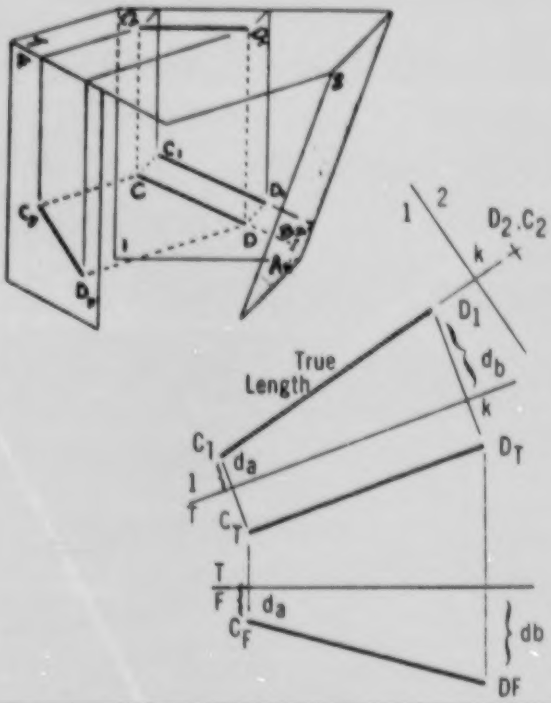
The point view of a line is shown on a plane that is perpendicular to the line. Study the examples below.

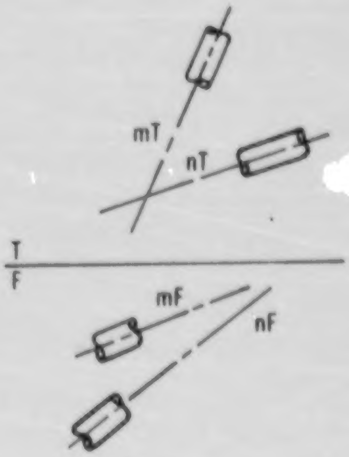


A
B
A_F
B_F
B1
1
B1,A1
True Length
AT
BT
T
F
T
1
AF
BF



C1
C
D
D1
CF
DF
1
2
D2.C2
k
D1
db
True Length
k
C1
da
DT
1
T
CT
T
F
da
CF
db
DF

Determine the point view of pipe m. Also, show pipe n in all views. In the appropriate view, label the perpendicular distance "d" between the pipes.



mT
nT
T
F
mF
nF

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Levens, A. S. and Cooper, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.

Title: *Point View of a Line*

NAME OF SCHOOL		Drawn by: ________ Date: ________	81

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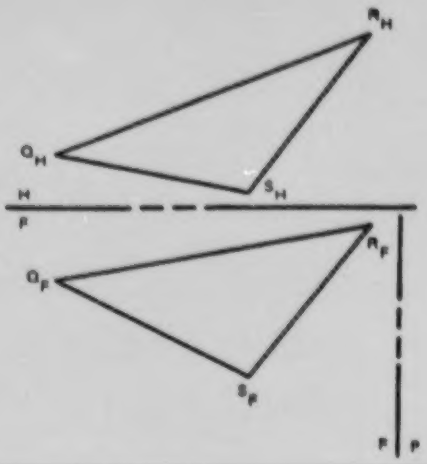
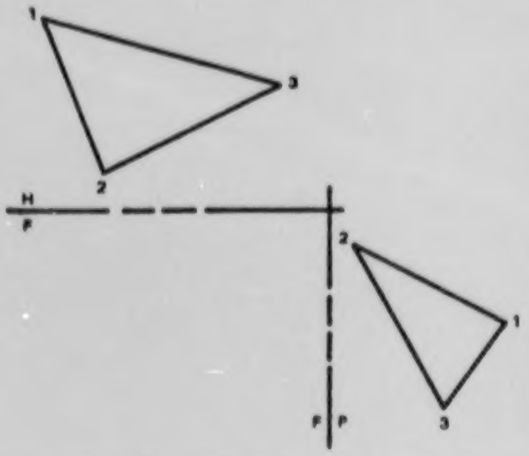
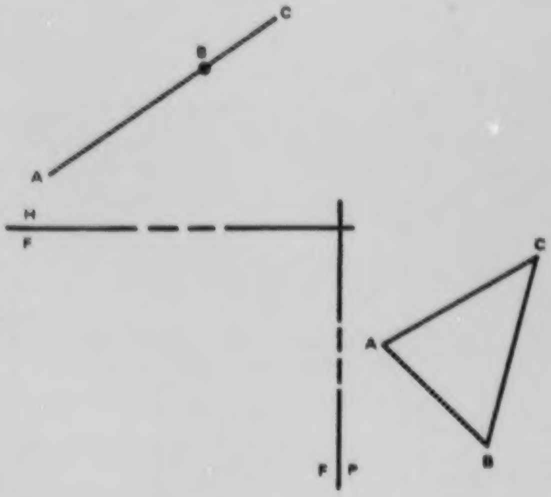
DRAW THE FORM ON THE BLANK PLANE.



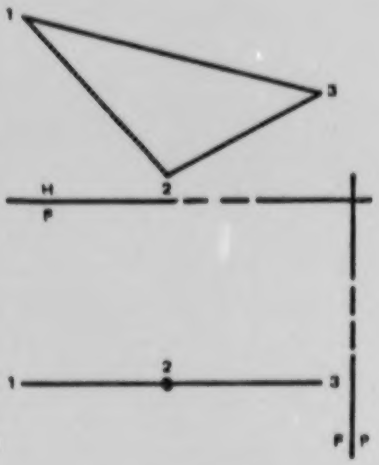
R_H
Q_H
S_H
H
F
R_F
Q_F
S_F
F
P



1
3
2
H
F
2
1
3
F
P



C
B
A
H
F
C
A
B
F
P



1
3
2
H
F
2
1
3
F
P

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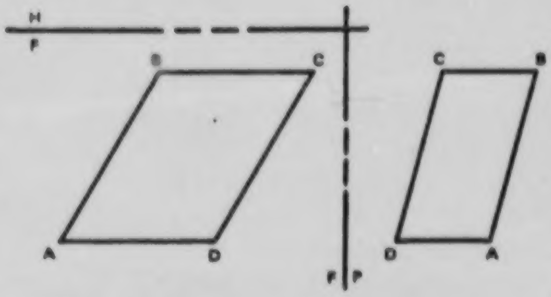
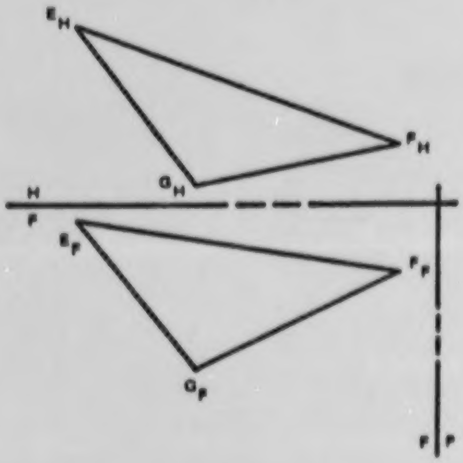
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.



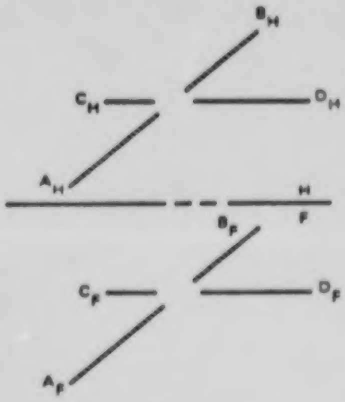
H
F
B
C
A
D
C
B
D
A
F
P



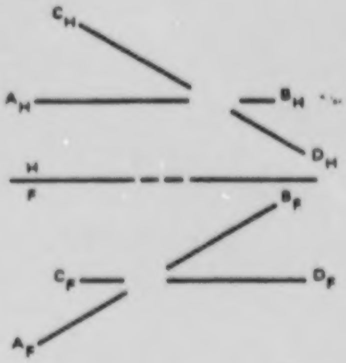
E_H
F_H
G_H
H
F
E_F
F_F
G_F
F
P

DESCRIPTIVE GEOMETRY	NAME	SECTION	DATE	PROBLEM 20-K

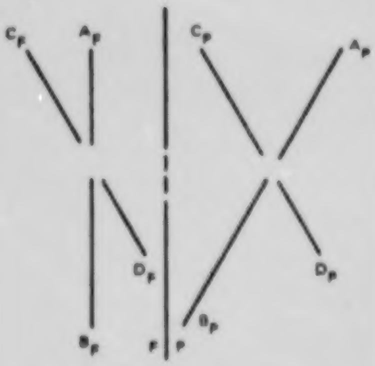
FIND THE VISIBILITY OF THE LINES (WHICH LINE IS IN FRONT OF EACH PLANE?)


B_H
C_H
D_H
A_H
H
F
B_F
C_F
D_F
A_F

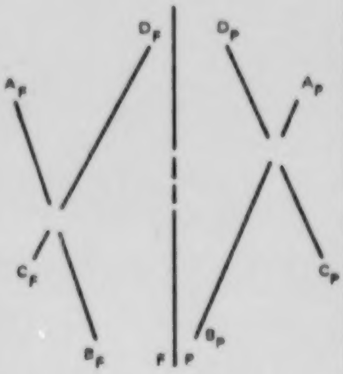
1.


C_H
A_H
B_H
D_H
H
F
B_F
C_F
D_F
A_F

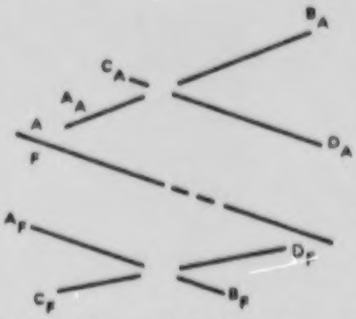
2.


C_F
A_F
C_P
A_P
D_F
D_P
B_P
B_F
F
P

3.


D_F
D_P
A_F
A_P
C_F
C_P
B_P
B_F
F
P

4.


B_A
C_A
A_A
A
F
D_A
A_F
D_F
C_F
B_F

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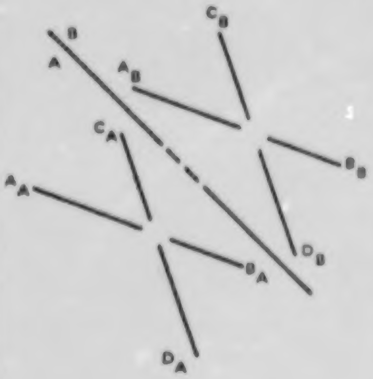
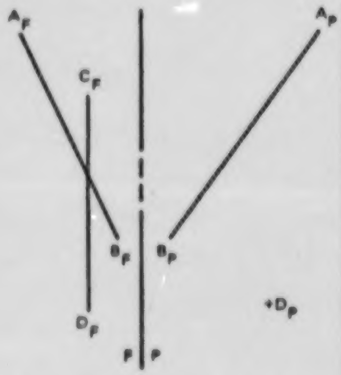
Wallach, Paul. *Drafting Problems*. Encino, California: Glencoe Publishing Company, 1981.

5.

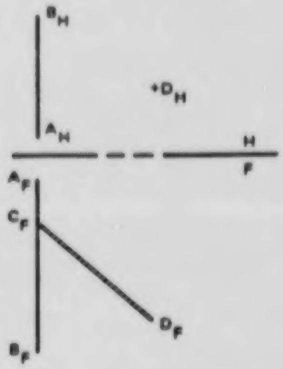

C_B
B
A
A_B
C_A
B_B
A_A
D_B
B_A
D_A

6.

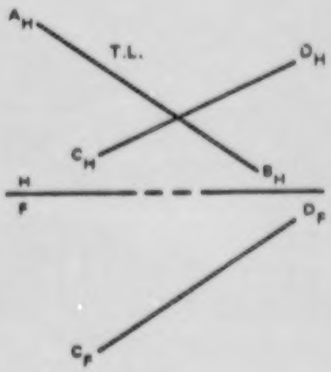
COMPLETE THE VIEWS OF THE INTERSECTING LINES.


A_F
A_P
C_F
B_F
B_P
D_F
$+D_P$
F
P

7.


B_H
$+D_H$
A_H
H
F
A_F
C_F
D_F
B_F

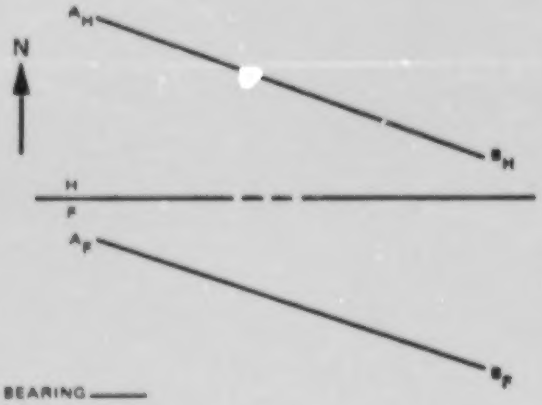
8.


A_H
T.L.
D_H
C_H
B_H
H
F
D_F
C_F

9.

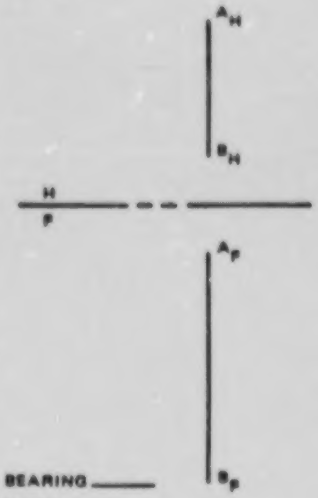
DESCRIPTIVE GEOMETRY	NAME	SECTION	DATE	PROBLEM 20-O

FIND THE BEARING AND SLOPE ANGLE.


N
A_H
B_H
H
F
A_F
B_F

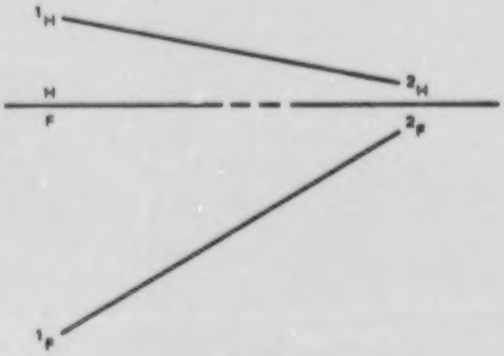
BEARING ______

SLOPE ______


A_H
B_H
H
F
A_F
B_F

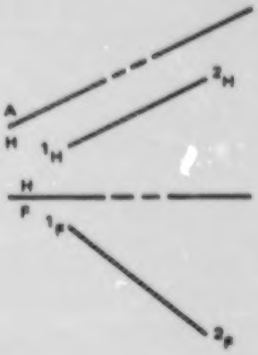
BEARING ______

SLOPE ______


1_H
2_H
H
F
2_F
1_F

BEARING ______

SLOPE ______


A
H
2_H
1_H
H
F
1_F
2_F

BEARING ______

SLOPE ______

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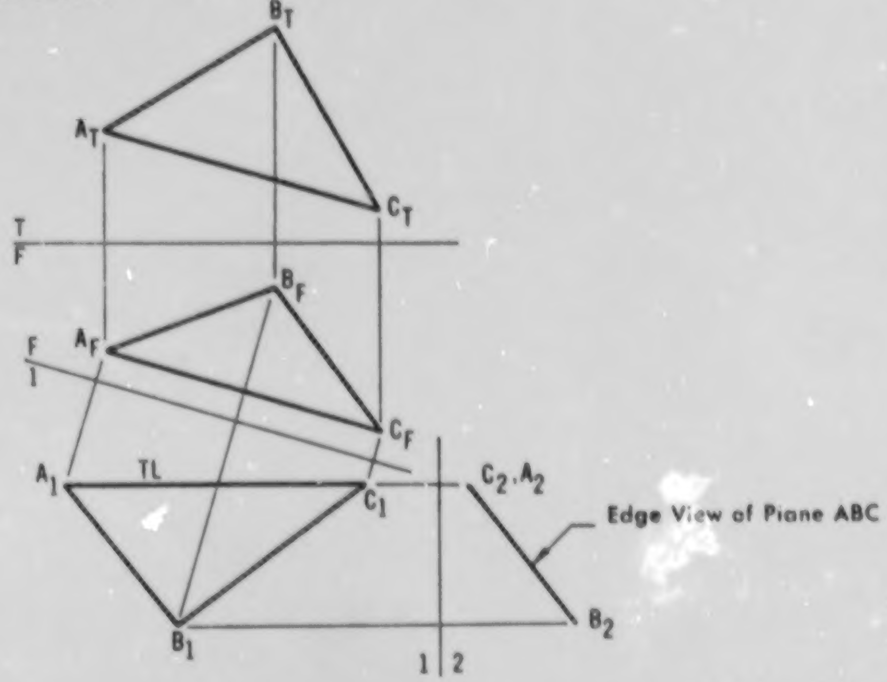
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

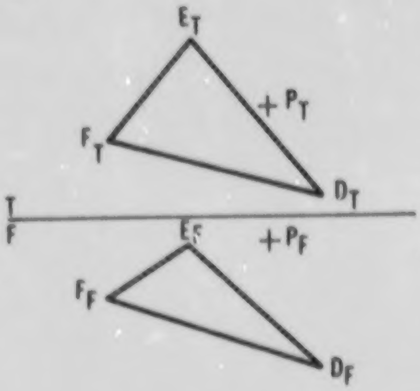
DESCRIPTIVE GEOMETRY	NAME	SECTION	DATE	PROBLEM 20-R

The edge view of a plane may be seen on a view that shows the point view of some line in the plane. Study the example below.



B_T
A_T
C_T
T
F
B_F
A_F
F
1
C_F
A_1
TL
C_1
C_2, A_2
Edge View of Plane ABC
B_1
B_2
1
2

Obtain an edge view of surface DEF. Also, show point P in all views. In the appropriate view, label the perpendicular distance from P to surface DEF, "d".



E_T
$+ P_T$
F_T
D_T
T
F
E_F
$+ P_F$
F_F
D_F

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Levens, A. S. and Cooper, S. J. Problems in Mechanical Drawing. 5th ed. New York: McGraw-Hill Book Company, 1980.

Title: *Edge View of a Plane*

NAME OF SCHOOL

Drawn by __________
Date __________

82

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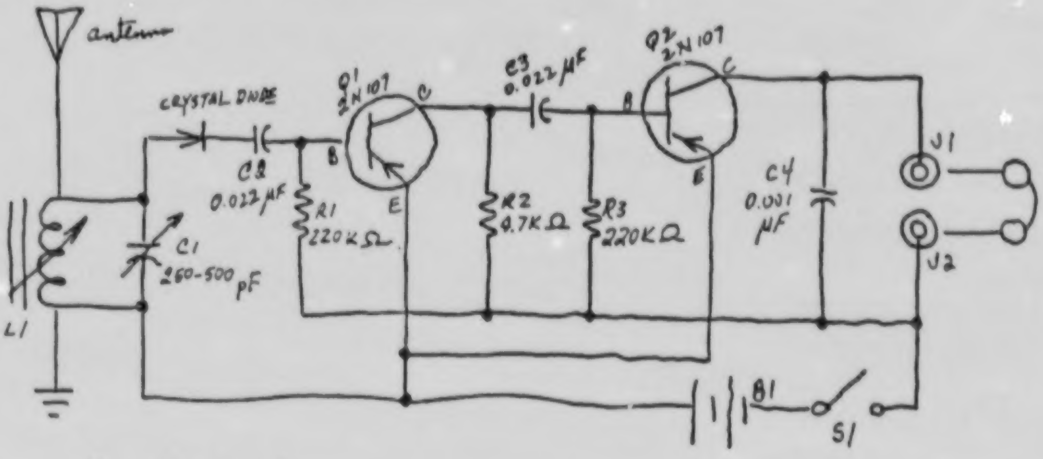
UNIT X ELECTRICAL AND ELECTRONIC DRAFTING

DRAW THE SCHEMATIC CALLED FOR BY THE ENGINEER.


antenna
CRYSTAL DIODE
Q1
2N107
C
B
E
C2
0.022 μF
R1
220KΩ
C3
0.022 μF
R2
4.7KΩ
R3
220KΩ
Q2
2N107
B
C
E
C4
0.001
μF
J1
J2
L1
C1
260-500 pF
B1
S1

transistor radio

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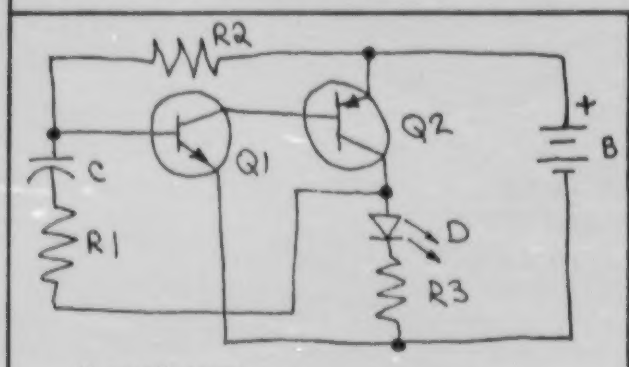
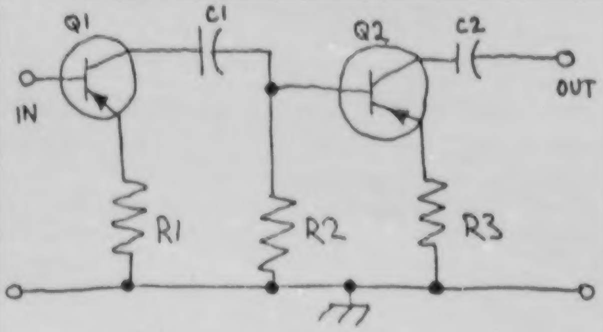
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

ELECTRONICS	NAME	SECTION	DATE	PROBLEM
				28-G

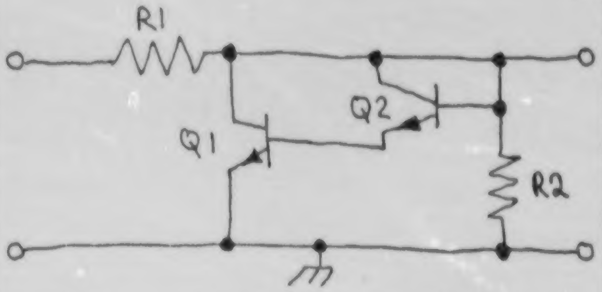
DRAW THE SCHEMATIC FROM THE ENGINEER'S SKETCHES.


R2
Q1
Q2
+
B
C
R1
D
R3

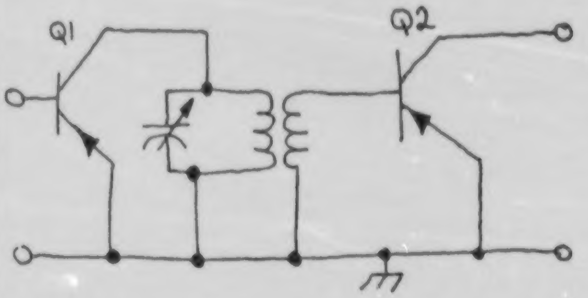
FLASHER UNIT


Q1
C1
Q2
C2
IN
OUT
R1
R2
R3

RC COUPLED AMPLIFIER



DIRECT-COUPLED SHUNT REGULATOR CIRCUIT



TRANSFORMER COUPLING

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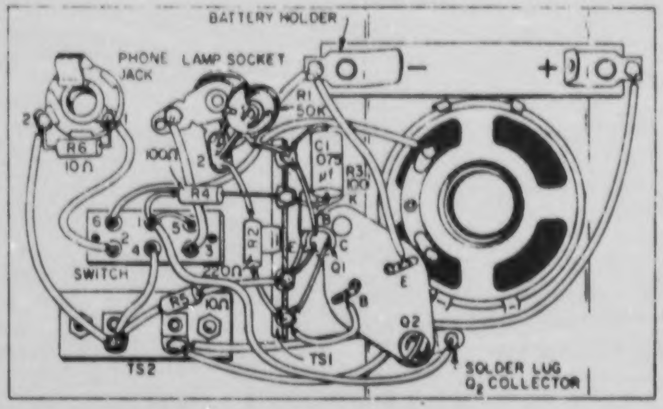
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

ELECTRONICS	NAME	SECTION	DATE	PROBLEM 28-H

DRAW THE SCHEMATIC DIAGRAM FOR THE DEVICE SHOWN. THE SWITCH USED IS A DOUBLE-POLE DOUBLE-THROW (DPDT).


BATTERY HOLDER
PHONE JACK
LAMP SOCKET
2
1
R6
10 Ω
100Ω
2
R1
50K
C1
.075 μf
R3
100 K
R4
6
1
5
2
4
3
SWITCH
R2
220Ω
B
E
C
Q1
E
B
Q2
R5
10Ω
TS2
TS1
SOLDER LUG
Q_2 COLLECTOR
−
+

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Brown, Walter. Drafting for Industry Workbook. South Holland, Illinois: Goodheart-Willcox Publishing Company, 1980.

NO. 127

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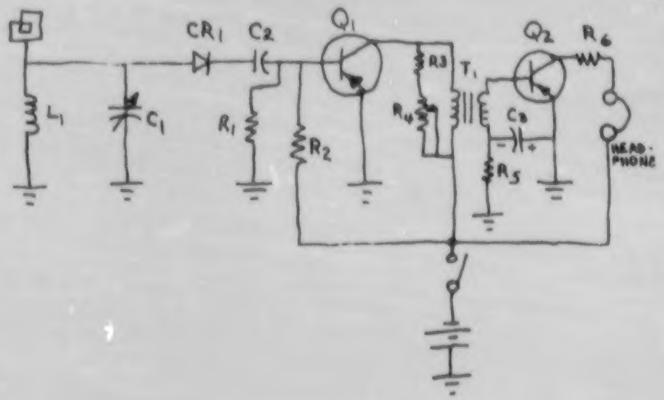
REDRAW THE FOLLOWING SKETCH AND ADD THE INFORMATION LISTED BELOW. AVOID CROWDING AND WASTED SPACES.

R_1, R_2, 220K, 1/2W
R_3, R_6, 1K, 1/2W
R_4 100K POT
R_5 100K, 1/2W
CR_1, 1N63

C_1, 0-365pF
C_2, .01UF
C_3, 10UF, 25V
Q_1, 2N663



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Brown, Walter. Drafting for Industry Workbook. South Holland, Illinois: Goodheart-Willcox Publishing Company, 1980.

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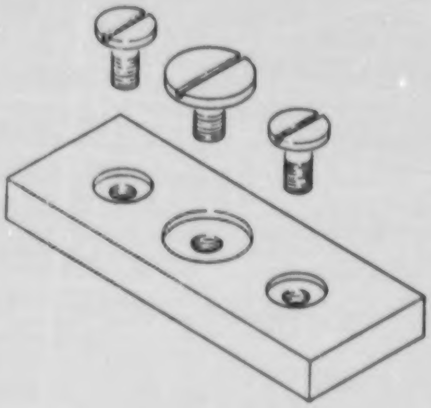
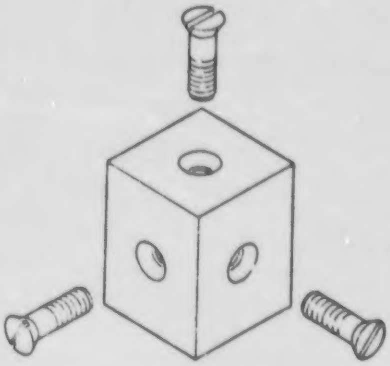
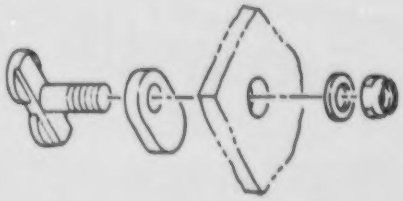
NO. 128

UNIT XI TECHNICAL ILLUSTRATION

DRAW THE OBJECTS USING TECHNICAL ILLUSTRATION TECHNIQUES.



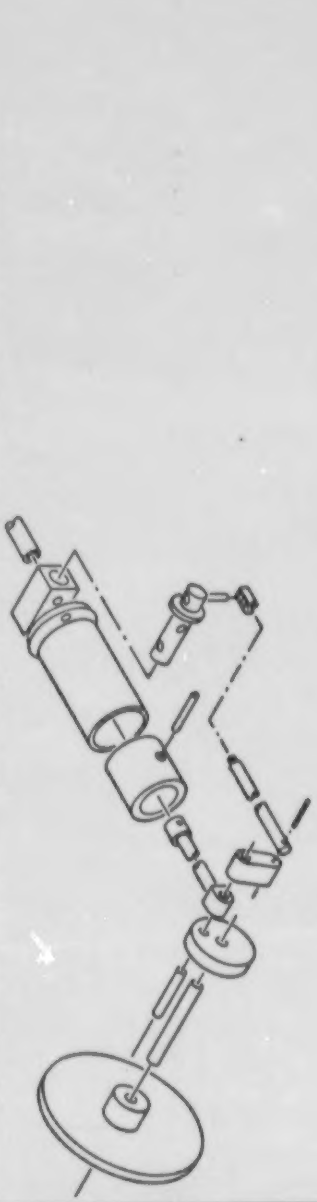




This drawing is from the following source and is used by permission.
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

TECHNICAL ILLUSTRATION	NAME	SECTION	DATE	PROBLEM 23-F

DRAW THE EXPLODED VIEW USING TECHNICAL ILLUSTRATION TECHNIQUES (SCALE 2:1).



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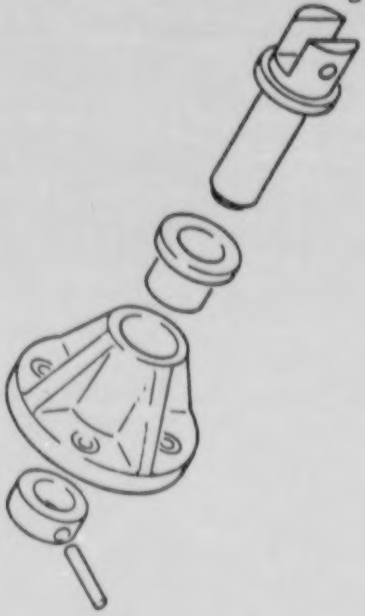
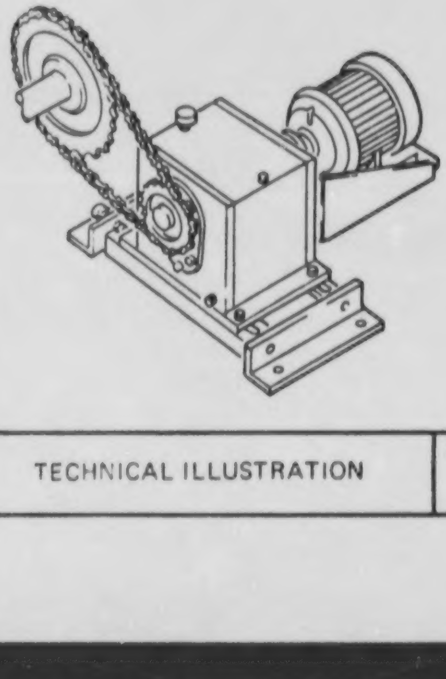
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

TECHNICAL ILLUSTRATION	NAME	SECTION	DATE	PROBLEM 23-J

BEST COPY AVAILABLE

DRAW THE OBJECTS USING TECHNICAL ILLUSTRATION TECHNIQUES.





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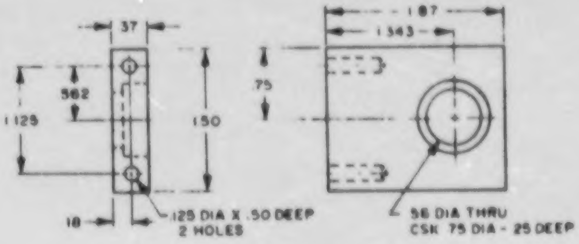
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

TECHNICAL ILLUSTRATION	NAME	SECTION	DATE	PROBLEM 23-L

PREPARE A TECHNICAL ILLUSTRATION OF THE OBJECT IN ISOMETRIC USING OUTLINE SHADING.



.37
.562
1.125
1.50
.18
.125 DIA X .50 DEEP
2 HOLES
1.87
1.343
.75
.56 DIA THRU
CSK .75 DIA - .25 DEEP

BEARING MOUNT

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Brown, Walter. *Drafting for Industry Workbook*.
South Holland, Illinois: Goodheart-Willcox
Publishing Company, 1980.

NO. 133

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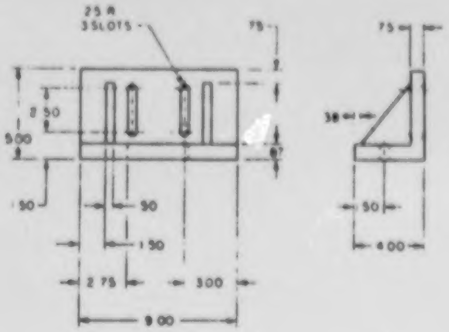
PREPARE A TECHNICAL ILLUSTRATION OF THE OBJECT SHOWN. THE ILLUSTRATION IS TO BE A DIMETRIC DRAWING USING PENCIL SHADING. SELECT THE AXES FROM THOSE SUGGESTED IN THE TEXT WHICH WILL PRESENT THE BEST VIEW.



SLOTTED ANGLE PLATE

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Brown, Walter. Drafting for Industry Workbook.
South Holland, Illinois: Goodheart-Willcox
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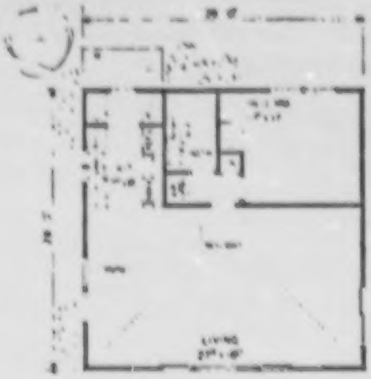
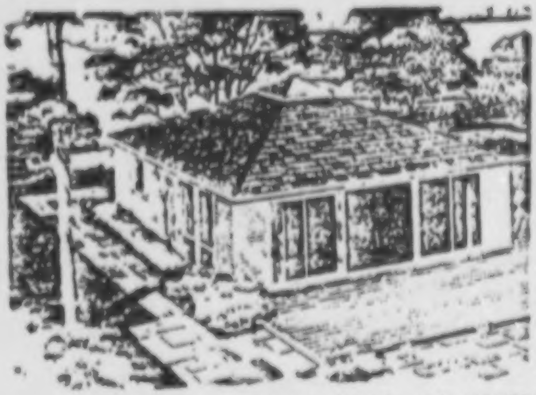
NO. 134

UNIT XII ARCHITECTURAL DRAFTING





HOME PLANNERS, INC., DETROIT

DRAW THE FLOOR PLAN TO A SCALE OF: 1/4" = 1'-0"

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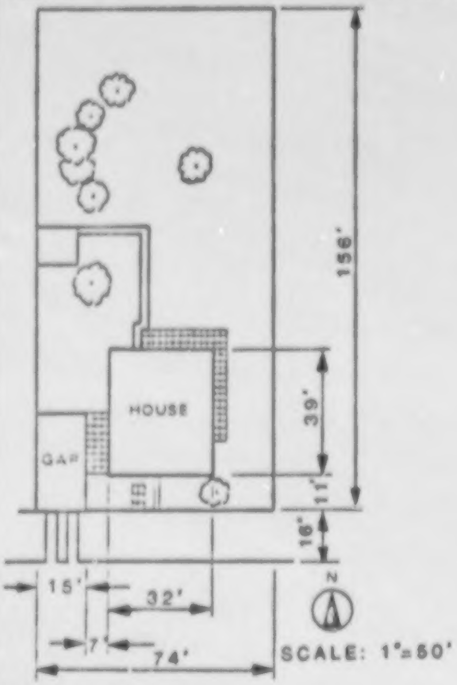
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

ARCHITECTURAL DRAFTING	NAME	SECTION	DATE	PROBLEM 32-A

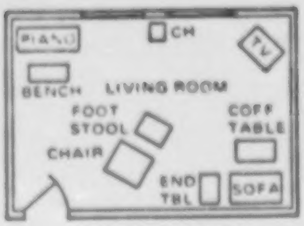

156'
HOUSE
GAR
39'
11'
16'
N
15'
32'
7'
74'
SCALE: 1"=50'

REDRAW THIS PLOT PLAN.

USE A SCALE OF: 1"=20'

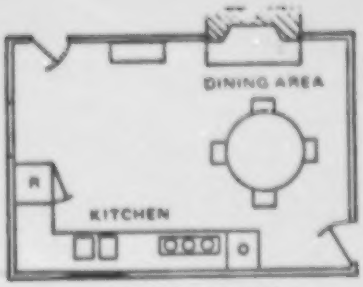
This drawing is from the following source and is used by permission.
Wallach, Paul. _Drafting Problems_. Encino, California. Glencoe Publishing Company, 1981.

ARCHITECTURAL DRAFTING	NAME	SECTION	DATE	PROBLEM 32-C


PIANO
CH
TV
BENCH
LIVING ROOM
FOOT STOOL
COFF TABLE
CHAIR
END TBL
SOFA

19'-0"x13'-0"

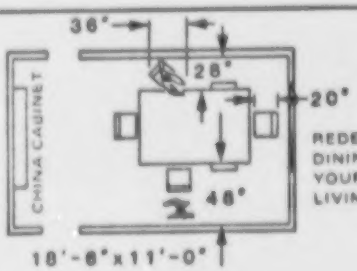
REDESIGN THIS LIVING ROOM AND PLACE IN THE FURNITURE FOR YOUR STYLE OF LIVING.


DINING AREA
R
KITCHEN

22'-6"x15'-6"

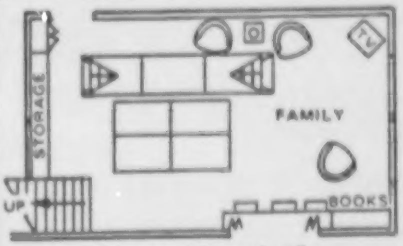
REDESIGN A FAMILY KITCHEN FOR YOUR LIVING STYLE.

SCALES: 3/32"=1'-0"


36"
28"
20"
48"
CHINA CABINET

18'-6"x11'-0"

REDESIGN A FORMAL DINING ROOM FOR YOUR STYLE OF LIVING.


TV
STORAGE
FAMILY
UP
BOOKS

24'-0"x14'-3"

REDESIGN A BASEMENT FAMLY ROOM FOR YOUR STYLE OF LIVING.

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Kallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

ARCHITECTURAL DRAFTING	NAME	SECTION	DATE	PROBLEM 32-1

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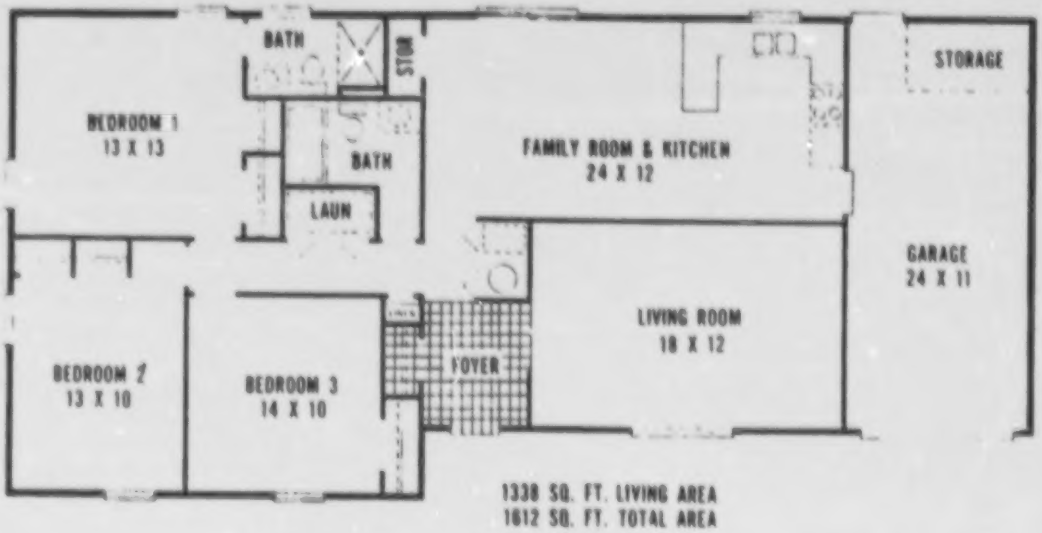
BATH
STOR
BEDROOM 1
13 X 13
BATH
LAUN
FAMILY ROOM & KITCHEN
24 X 12
STORAGE
GARAGE
24 X 11
LIVING ROOM
18 X 12
FOYER
BEDROOM 2
13 X 10
BEDROOM 3
14 X 10
1338 SQ. FT. LIVING AREA
1612 SQ. FT. TOTAL AREA

PREPARE DRAWINGS AS INDICATED IN THE FOLLOWING PROBLEMS FOR THE HOUSE ILLUSTRATED IN THE PRESENTATION DRAWING SHOWN. PROBLEMS ARE BEST SUITED FOR B OR C SIZE SHEETS BUT MAY BE SCALED DOWN AND DRAWN ON THE SHEETS INCLUDED HERE.

NO. 119

PREPARE A SCALED DRAWING OF THE FLOOR PLAN OF THE HOUSE. INCLUDE ALL NECESSARY DIMENSIONS AND NOTES. DO NOT INCLUDE ELECTRICAL PLAN.

NO. 120

MAKE A FOOTING AND FOUNDATION PLAN FOR THE HOUSE. THERE IS NO BASEMENT AND THE FOUNDATION IS A 36 INCH STEM WALL ON A FOOTING. ON THE SAME SHEET, PREPARE A DETAIL SECTION OF THE FOUNDATION SHOWING ANY BEAMS AND PIERS NECESSARY IN THE FOUNDATION TO SUPPORT THE FLOOR AND INTERIOR WALLS.

NO. 121

TRACE THE FLOOR PLAN PREPARED IN THE PROBLEM AND ADD AN ELECTRICAL WIRING PLAN FOR THE HOUSE. CHECK THE LOCAL ELECTRICAL CODE, IF ONE IS AVAILABLE, FOR THE REQUIREMENTS ON SPACING WALL OUTLETS. SHOW LINES TO SWITCHES ON ALL OUTLETS CONTROLLED BY SWITCHES.

NO. 122

MAKE A FRONT ELEVATION FOR THE HOUSE. ADD DIMENSIONS AND NOTES WHERE NECESSARY.

NO. 123

DRAW A SIDE ELEVATION FOR THE HOUSE AND DIMENSION.

NO. 124

MAKE A WALL SECTION DRAWING TO SHOW DETAILS OF CONSTRUCTION. ADD DIMENSIONS AND NOTES WHERE NECESSARY.

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Brown, Walter. Drafting for Industry Workbook.
South Holland, Illinois: Goodheart-Willcox
Publishing Company, 1980.

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UNIV XIII PIPING DRAFTING

REDRAW THE SYMBOLS FOR THE SCREW CONNECTION FITTINGS.

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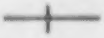
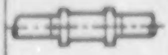
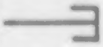
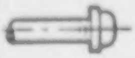
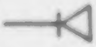
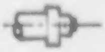
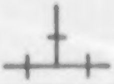
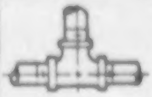
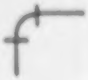
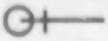
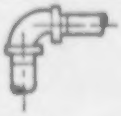
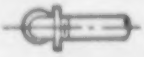
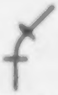
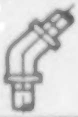
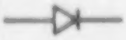
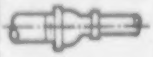
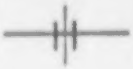
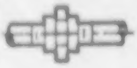
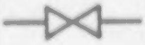
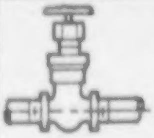
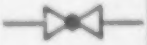
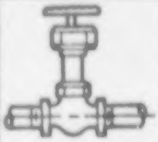
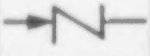
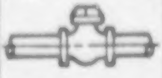
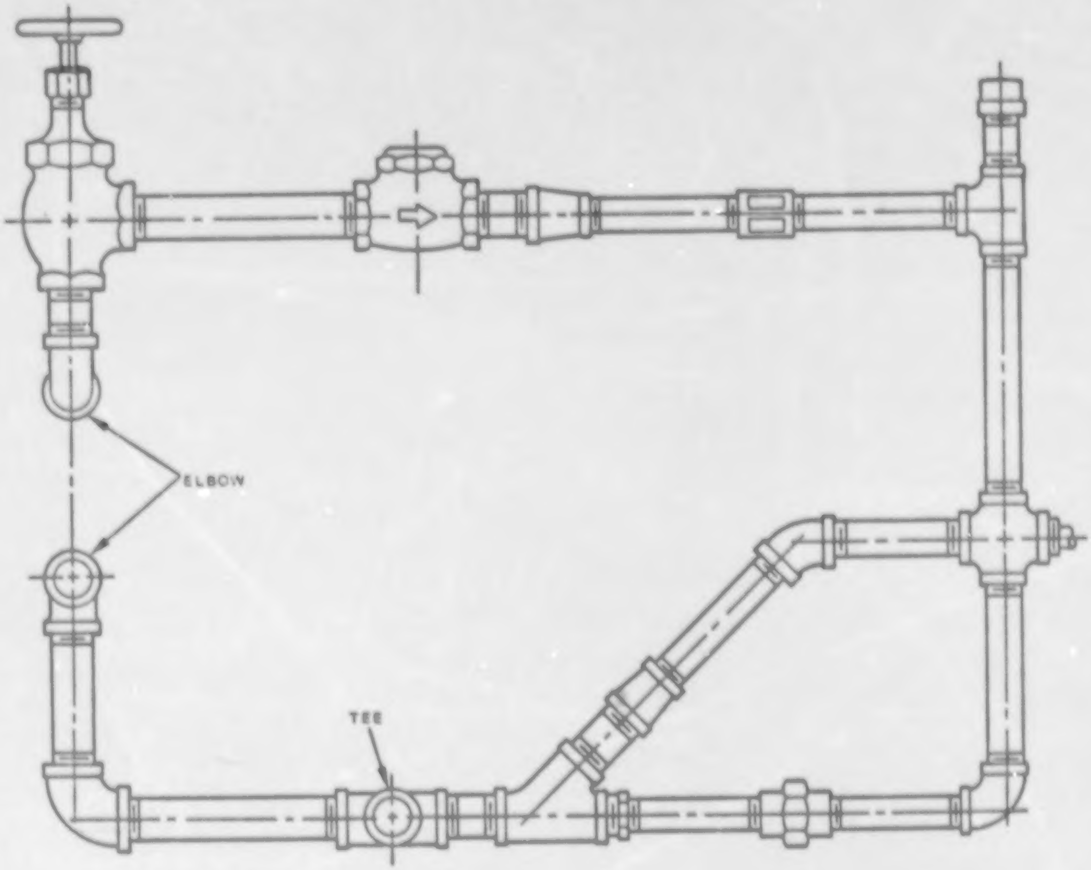
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

COMPONENT	SINGLE LINE	DOUBLE LINE	SINGLE LINE	DOUBLE LINE
COUPLING				
CAP				
PLUG				
TEE				
90° ELL TURNED DOWN	 	 		
45° ELL				
REDUCER				
UNION				
GATE VALVE				
GLOBE VALVE				
CHECK VALVE				

PIPE DRAFTING	NAME	SECTION	DATE	PROBLEM 29–A

DRAW A SINGLE-LINE ISOMETRIC OF THIS PIPE SYSTEM USING A SMALLER SCALE.



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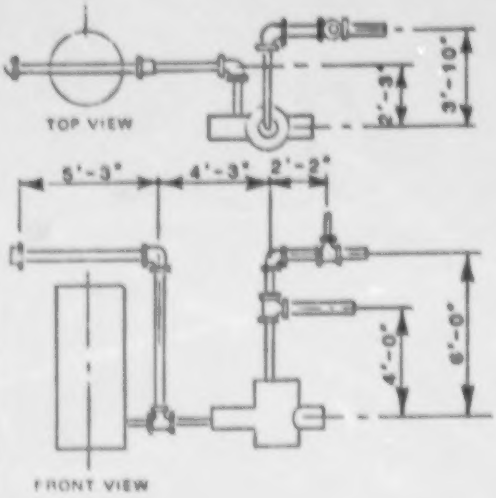
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

PIPE DRAFTING	NAME	SECTION	DATE	PROBLEM 29-C

DRAW A SINGLE LINE ORTHOGRAPHIC AND A SINGLE LINE ISOMETRIC OF THIS PIPE SYSTEM. SELECT SCALE FOR DRAWING AREA.


TOP VIEW
2'-3"
3'-10"
5'-3"
4'-3"
2'-2"
4'-0"
6'-0"
FRONT VIEW

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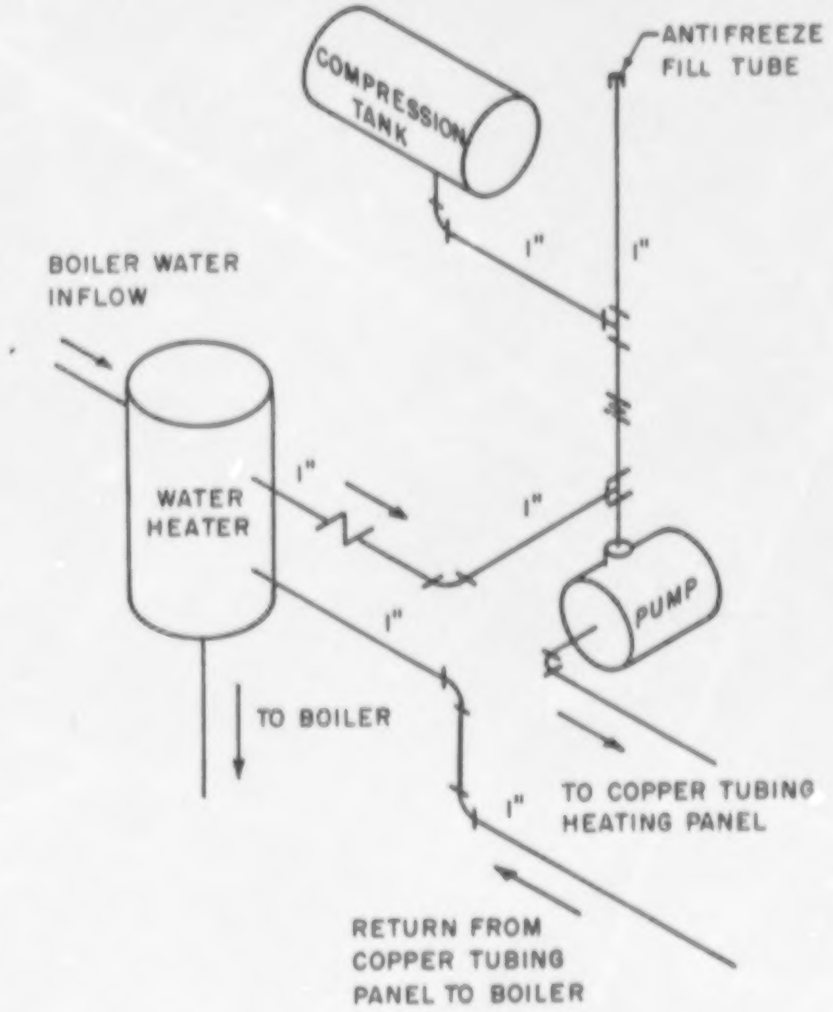
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.

PIPE DRAFTING	NAME	SECTION	DATE	PROBLEM 29-1

MAKE THE FOLLOWING DRAWINGS OF THIS PIPING SYSTEM ON SHEET 94.

1 DRAW A FLOW DIAGRAM.

2 MAKE A ONE-VIEW DOUBLE-LINE DRAWING. SELECT THE VIEW THAT SHOWS THE SYSTEM MOST CLEARLY. SELECT YOUR OWN SCALE.


COMPRESSION TANK
ANTIFREEZE FILL TUBE
1"
1"
BOILER WATER INFLOW
WATER HEATER
1"
1"
PUMP
1"
TO BOILER
TO COPPER TUBING HEATING PANEL
1"
RETURN FROM COPPER TUBING PANEL TO BOILER

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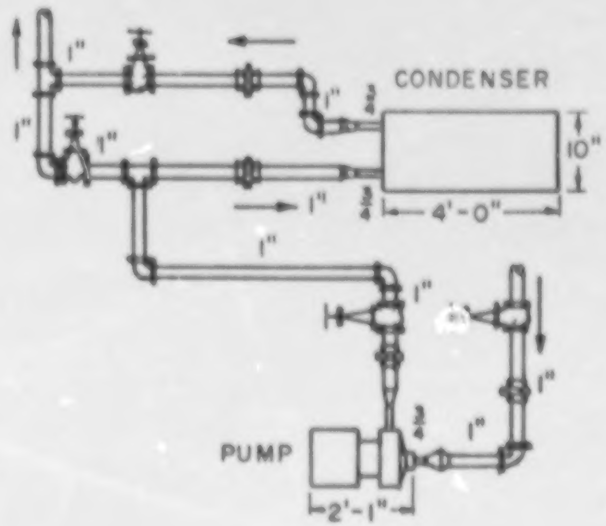
Spence, William P. Drafting Worksheets.
Revised. Peoria, Illinois: Bennett
Publishing Company, 1981.

PIPING DRAWINGS

PIPING DRAWINGS


1"
1"
1"
1"
CONDENSER
1"
3/4
10"
1"
3/4
4'-0"
1"
1"
1"
1"
3/4
1"
PUMP
2'-1"

MAKE A SINGLE-LINE ONE-VIEW DIAGRAM.

MAKE A SINGLE-LINE ISOMETRIC PICTORIAL DIAGRAM.

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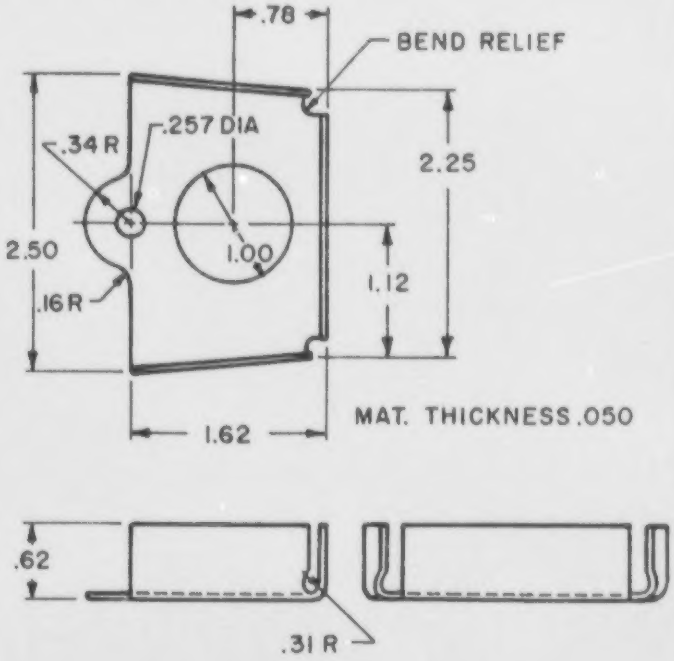
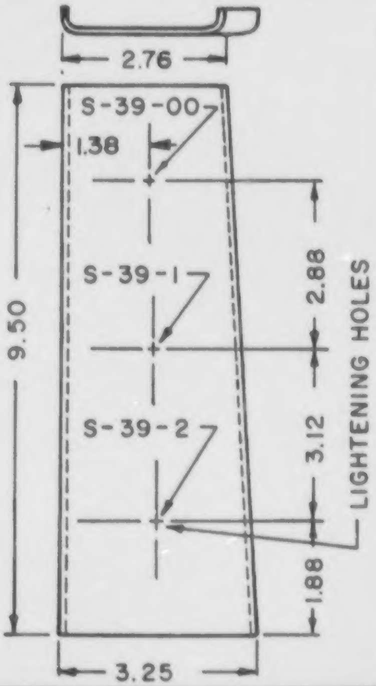
Spence, William P. *Drafting Worksheets*. Revised. Peoria, Illinois: Bennett Publishing Company, 1981.

UNIT XIV AEROSPACE DRAFTING

DEVELOP A FULL-SIZE PATTERN FOR THIS RUDDER HINGE BRACKET. RECORD OVERALL DIMENSIONS. LOCATE BEND LINES BY DIMENSIONING. USE GENERAL USE RELIEF HOLES ON THE CORNERS.


.78
BEND RELIEF
.257 DIA
.34 R
2.25
2.50
1.00
1.12
.16 R
1.62
MAT. THICKNESS .050
.62
.31 R

MAKE A LAYOUT DRAWING FOR THIS DOOR JAMB. DRAW THE LIGHTENING HOLES USING A TABLE TO FIND THEIR SIZES. USE THE SCALE $\frac{1}{2}$" = 1". DRAW A FULL SIZE SECTION THROUGH HOLE S-39-2.


2.76
S-39-00
1.38
S-39-1
2.88
9.50
S-39-2
3.12
LIGHTENING HOLES
1.88
3.25

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Spence, William P. Drafting Worksheets. Revised. Peoria, Illinois: Bennett Publishing Company, 1981.

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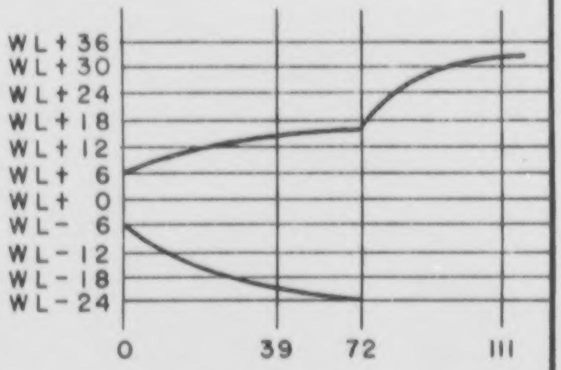
Spence, William P. Drafting Worksheets. Revised. Peoria, Illinois: Bennett Publishing Company, 1981.

CHORD LINE

STATION DISTANCE	UPPER ORDINATES	LOWER ORDINATES

DRAW AN AIRFOIL WITH A CHORD 50" LONG. USE THE AIRFOIL ORDINATE TABLE 2415 TO PROVIDE THE PLOTTING DATA NEEDED IN THE TABLE AT THE LEFT.
DRAW TO THE SCALE 1" = 5".

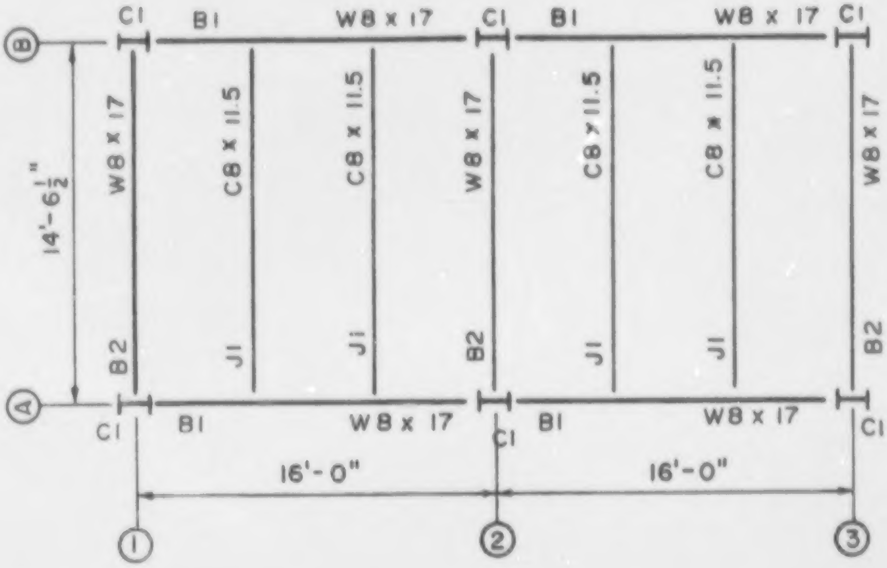


ON SHEET 86 DRAW THE BULKHEAD FOR STATION LINE 39 OF THIS AIRCRAFT FUSELAGE. SCALE $\frac{1}{4}$" = 1". DRAW FULL SIZE IF LARGER PAPER IS AVAILABLE.

DATA FOR STATION LINE 39

	POINT 1		POINT 2		POINT 3	
	WL	BL	WL	BL	WL	BL
LOWER	+4.0	18.50	-19.5	0	-13.25	15.0
UPPER	+4.0	18.50	+12.5	0	+9.75	15.0

UNIT XI STRUCTURAL DRAFTING


B
A
C1
B1
W8 x 17
C1
B1
W8 x 17
C1
14'-6½"
W8 x 17
C8 x 11.5
C8 x 11.5
W8 x 17
C8 x 11.5
C8 x 11.5
W8 x 17
B2
J1
J1
B2
J1
J1
B2
C1
B1
W8 x 17
C1
B1
W8 x 17
C1
16'-0"
16'-0"
1
2
3

NOTES

CHANNELS EQUALLY SPACED. CHANNELS CONNECTED TO W BEAM WITH ONE ANGLE CONNECTOR $2\frac{1}{2}" \times 2" \times \frac{1}{4}" \times 5\frac{1}{2}"$ HAVING TWO $\frac{3}{4}"$ DIA HOLES. CONNECTORS ARE WELDED TO CHANNEL AND BOLTED TO BEAM. C6 x 11.5 CHANNEL IS 6" x 2"

W BEAMS B1 ARE 15'-$1\frac{1}{2}"$ LONG. HAS TWO ANGLE CONNECTORS $\frac{1}{2}" \times \frac{1}{4}" \times 5\frac{1}{2}"$ WELDED TO BEAM AND BOLTED TO COLUMN. W8 x 17 IS 8" x $5\frac{1}{4}"$. BEAM FLANGE 5.25", DEPTH 8.00", WEB THICKNESS 0.230".

COLUMNS ARE W8 x 31 MEMBERS 8'-0" LONG. BASE IS 1'-0" x 1'-7" x $1\frac{1}{4}"$ THICK WITH TWO $\frac{7}{8}"$ DIA HOLES. C1 FLANGE 8.00", DEPTH 8.00", WEB THICKNESS 0.288". TWO ∠ $3\frac{1}{2}" \times 3\frac{1}{2}" \times \frac{3}{8}" \times 6"$ WELDED TO C1 AND BASE.

DRAWING DIRECTIONS

1. ON SHEET 98 MAKE A COMBINED ROOF FRAMING PLAN AND ERECTION DRAWING. SCALE $\frac{1}{4}"$ = 1'-0".
2. ON SHEET 99 DRAW THE FOLLOWING:
   A. DETAIL DRAWING OF BEAM B1.
   B. DETAIL DRAWING OF THE CHANNEL.
3. ON ANOTHER SHEET DRAW A DETAIL DRAWING OF THE COLUMN. BEAM B2 HAS SAME ANGLE CONNECTIONS AS B1. SCALE $\frac{3}{4}"$ = 1'-0".

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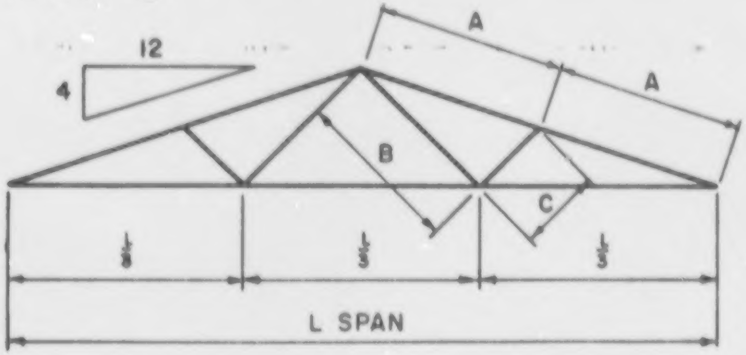
is used by permission.
Spence, William P. Drafting Worksheets.
Revised. Peoria, Illinois: Bennett
Publishing Company, 1961.

STRUCTURAL DRAWING		97

STRUCTURAL DRAWING

MAKE A PRODUCTION DRAWING OF THIS WOOD TRUSS. SCALE $\frac{1}{2}$" = 1'-0". BOLTS $\frac{1}{2}$" DIA. SPLIT RINGS 2$\frac{1}{2}$".



TRUSS SPAN	DIMENSIONS		
	A	B	C
20'-0"	5'-3 $\frac{1}{2}$"	4'-8 $\frac{3}{16}$"	2'-3 $\frac{15}{16}$"
26'-0"	6'-10 $\frac{3}{16}$"	6'-1 $\frac{3}{16}$"	3'-0 $\frac{7}{16}$"
32'-0"	8'-5 $\frac{3}{16}$"	7'-6 $\frac{3}{16}$"	3'-8 $\frac{7}{8}$"

TRUSS SPAN	LUMBER SIZES		
	INCLINED CHORDS	HORIZONTAL CHORD	WEB
20'-0"	2 x 6	2 x 4	2 x 4
26'-0"	2 x 6	2 x 4	2 x 4
32'-0"	2 x 8	2 x 6	2 x 4

131

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Spence, William P. Drafting Worksheets. Revised. Peoria, Illinois: Bennett Publishing Company, 1981.

100

UNIT XVI COMPUTER DRAFTING

USE THE INFORMATION IN THE DATA TABLE TO DRAW A FIGURE ON THE 1/4" GRAPH PAPER PROVIDED BELOW.

DATA TABLE

	X	Y	—	X	Y
(1)	43	27	—	55	14
(2)	55	14	—	30	10
(3)	30	10	—	43	27
(4)	43	27	—	32	88
(5)	32	88	—	10	10
(6)	10	10	—	30	10
(7)	55	14	—	70	20
(8)	70	20	—	32	88

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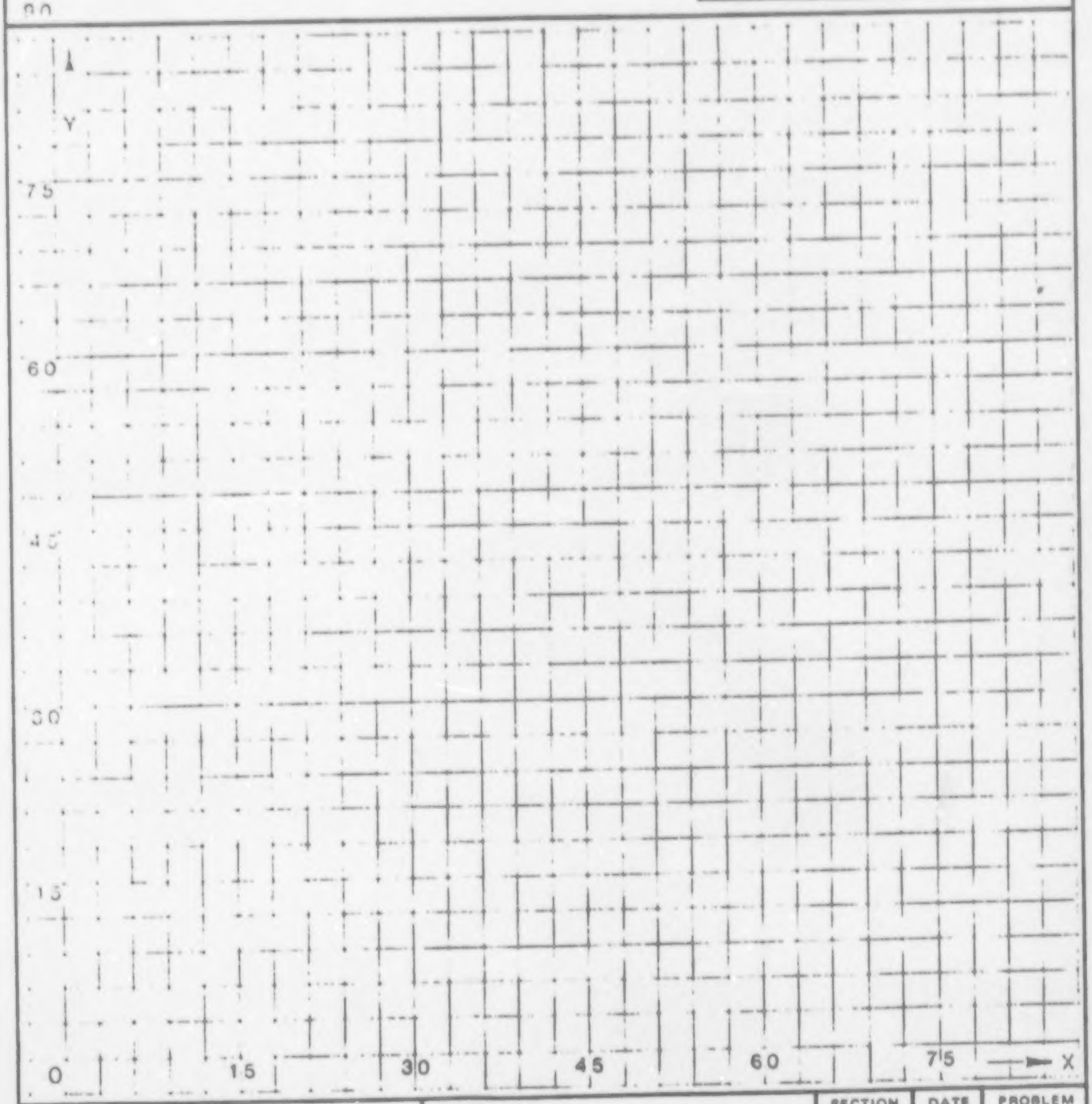
Wallach, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.



COMPUTER GRAPHICS	NAME	SECTION	DATE	PROBLEM 33–A

BEST COPY AVAILABLE

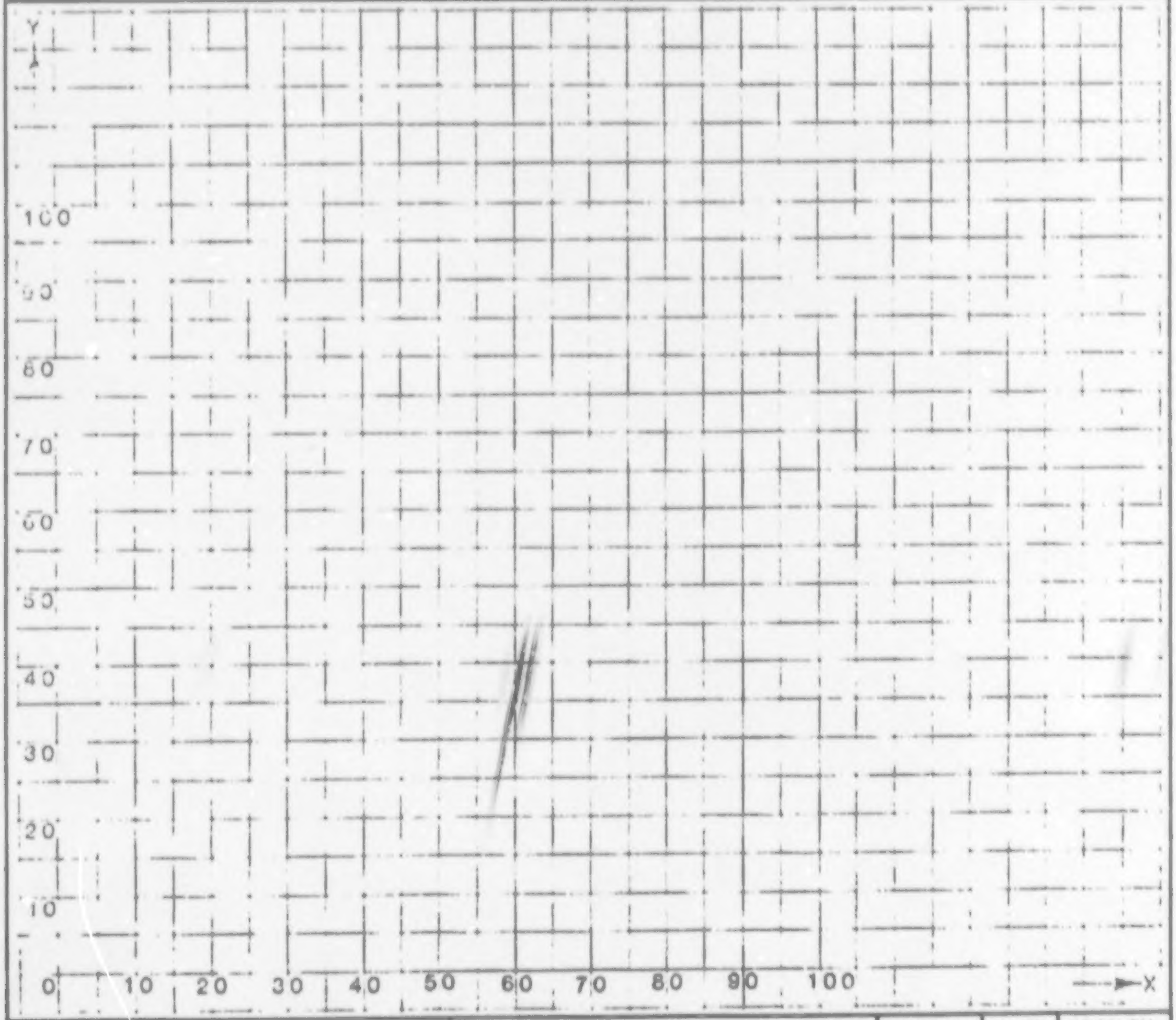
USE THE INFORMATION IN THE DATA TABLE TO DRAW A FIGURE ON THE 1/4" GRAPH PAPER PROVIDED BELOW.

DATA TABLE

	x	y	–	x	y
(1)	10	50	–	10	28
(2)	10	28	–	20	22
(3)	20	22	–	20	86
(4)	20	86	–	15	89
(5)	15	89	–	15	47
(6)	14	47	–	10	50
(7)	10	50	–	15	53
(8)	15	89	–	35	100
(9)	35	100	–	40	97
(10)	40	97	–	20	86
(11)	40	96	–	49	101
(12)	49	101	–	64	92
(13)	34	92	–	35	75
(14)	35	75	–	30	78
(15)	40	97	–	40	84
(16)	40	84	–	30	78

	x	y	–	x	y
(17)	30	78	–	30	28
(18)	30	28	–	20	22
(19)	30	28	–	35	25
(20)	35	25	–	35	75
(21)	64	92	–	64	53
(22)	64	53	–	54	47
(23)	54	47	–	54	36
(24)	54	36	–	35	25
(25)	54	36	–	70	27
(26)	70	27	–	70	38
(27)	70	38	–	54	47
(28)	64	65	–	90	50
(29)	90	50	–	70	38
(30)	70	27	–	90	39
(31)	90	39	–	90	50

This drawing is from the following source and is used by permission.
Kalisch, Paul. Drafting Problems. Encino, California: Glencoe Publishing Company, 1981.



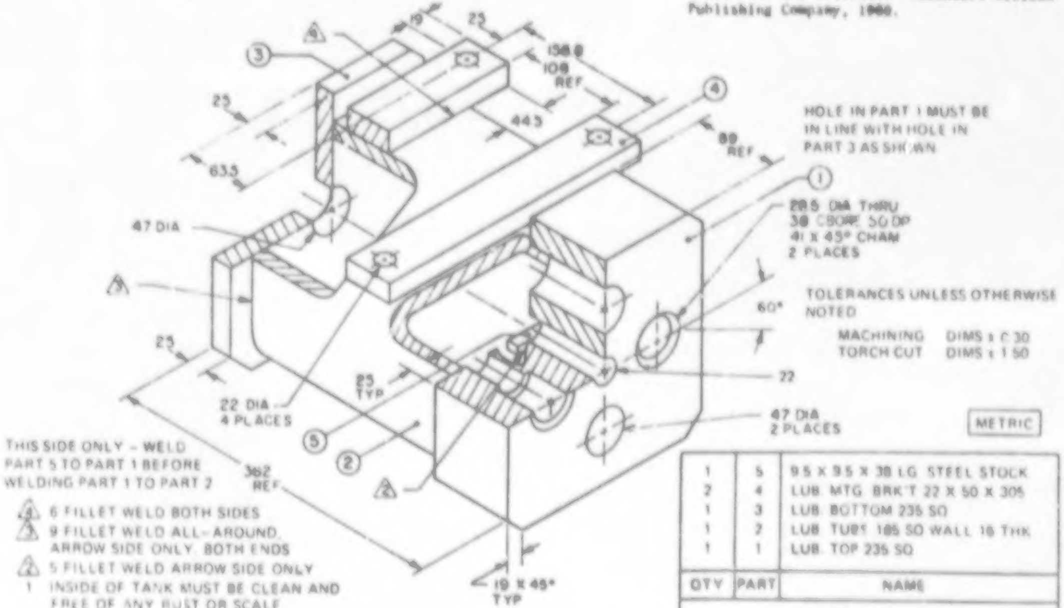
COMPUTER GRAPHICS	NAME	SECTION	DATE	PROBLEM 33-C

UNIT XVIII WELDING DRAFTING

MAKE WORKING DRAWINGS, INCLUDING THE SPECIFICATION OF WELDS BY SYMBOLS AND MATERIALS LISTS FOR THE OBJECTS BELOW. USE THE FOLLOWING SHEETS.

PROBLEM NO. 129

This drawing is from the following source and is used by permission.
Brown, Walter. Drafting for Industry Workbook. South Holland, Illinois: Goodheart-Willcox Publishing Company, 1980.


③
④
①
②
⑤
19
25
138.8
108
REF
25
44.5
63.5
89
REF
47 DIA
25
22 DIA
4 PLACES
25
TYP
362
REF
28.5 DIA THRU
38 CBORE 50 DP
41 X 45° CHAM
2 PLACES
60°
22
47 DIA
2 PLACES
19 X 45°
TYP
METRIC

HOLE IN PART 1 MUST BE IN LINE WITH HOLE IN PART 3 AS SHOWN

TOLERANCES UNLESS OTHERWISE NOTED
MACHINING DIMS ± 0.30
TORCH CUT DIMS ± 1.50

THIS SIDE ONLY – WELD PART 5 TO PART 1 BEFORE WELDING PART 1 TO PART 2

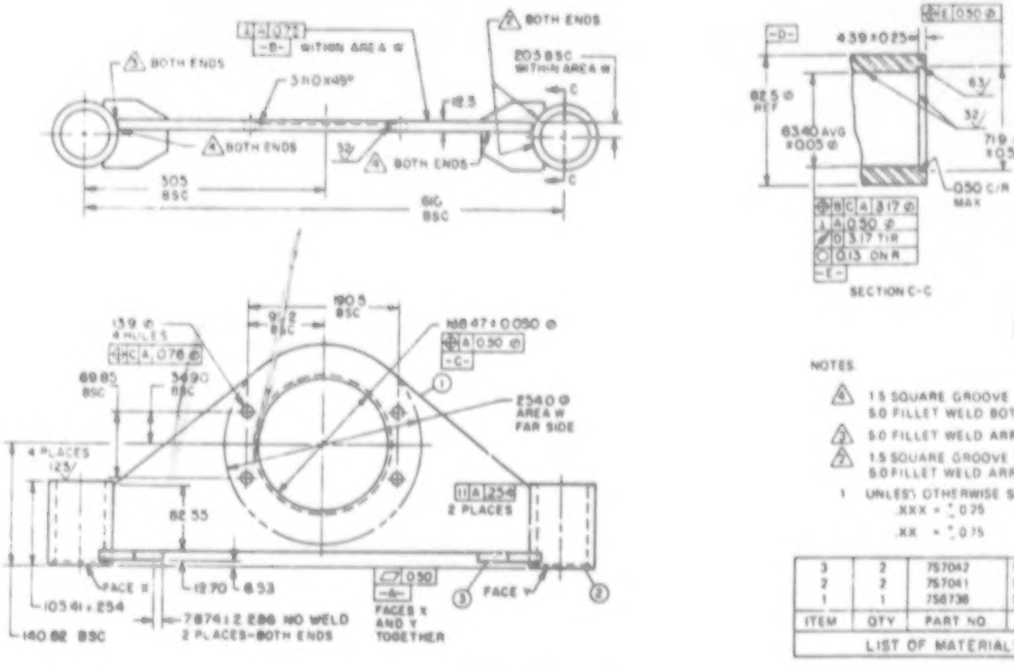
△4 6 FILLET WELD BOTH SIDES
△3 9 FILLET WELD ALL-AROUND, ARROW SIDE ONLY, BOTH ENDS
△2 5 FILLET WELD ARROW SIDE ONLY
1 INSIDE OF TANK MUST BE CLEAN AND FREE OF ANY RUST OR SCALE

QTY	PART	NAME
1	5	9.5 X 9.5 X 38 LG. STEEL STOCK
2	4	LUB. MTG. BRK'T 22 X 50 X 305
1	3	LUB. BOTTOM 235 SQ
1	2	LUB. TUBE 185 SQ WALL 16 THK
1	1	LUB. TOP 235 SQ

MATERIALS LIST

LUBRICATOR TANK BASE

PROBLEM NO. 130


BOTH ENDS
WITHIN AREA W
3.10 X 45°
BOTH ENDS
20.5 BSC WITHIN AREA W
12.5
C
C
BOTH ENDS
32/
BOTH ENDS
305
BSC
610
BSC
-D-
4.39 ± 0.25
0.50
82.5 Ø
REF
63
32/
63.40 AVG
±0.05 Ø
71.9 Ø
±0.50
0.50 C/R
MAX
3.17 Ø
0.50 Ø
3.17 TIR
0.15 ON R
-E-
SECTION C-C
190.5
BSC
95.2
BSC
168.47 ± 0.050 Ø
0.50 Ø
-C-
①
13.9 Ø
4 HOLES
0.76 Ø
69.85
BSC
34.90
BSC
254.0 Ø
AREA W
FAR SIDE
4 PLACES
125/
82.55
2.54
2 PLACES
FACE X
12.70
6.53
0.50
-A-
FACES X AND Y TOGETHER
③
FACE Y
②
105.41 ± 2.54
140.82 BSC
78.74 ± 2.286 NO WELD
2 PLACES–BOTH ENDS

METRIC

NOTES

△4 1.5 SQUARE GROOVE WELD, 5.0 FILLET WELD BOTH SIDES
△5 5.0 FILLET WELD ARROW SIDE
△7 1.5 SQUARE GROOVE WELD, 5.0 FILLET WELD ARROW SIDE
1 UNLESS OTHERWISE SPECIFIED
.XXX = ± 0.75
.XX = ± 0.75

ITEM	QTY	PART NO	NAME
3	2	757042	PLATE
2	2	757041	BUSHING
1	1	756736	SUPPORT

LIST OF MATERIALS

SUPPORT ASSEMBLY

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APPENDIX 5

TEACHER AIDS

DRAFTING TERMS #1

```
K A S R U U H G C O R I T V T R R J H W F O G X J D X A N R S C
X N W K O A D U W B Y I Q G J F M B F N A K N H A C J L J F W V
K Y Q Y I W Y I C V B X Z X Z M E T H J Z G I R S C F U V X F W
K N P Z B X Y Q E I L D R O J Z T M D E R Q M J L K S O W B X D
S E O P L X A Y U R M U U Q O N S F A X E R V A F B O O E Z Z H
R X Z G N K J H A G W J D N U J L D I L H E Z B H F J L K R L X
T C N D A Y D B T B P I E U E O Z W G L D X O M I M G J T E J S
H B U I A T I S V W F S R Z H J O N I N L N P B S N B C L T D Q
X Q L C O Q C W E C F H O A W C A U R C G E P A I Y L J X E R W
F Y B E K E R O V S L D I C L I F S C H O R T W N I A Y C M U S
O L O M R S T Y Z K L M S V R U K R J I U A A H Q H B K Q A K P
Z N B M T X R I H T K P I T S E C V O D J R G D B P V E M I V I
A Z J L V I J I H Y D D X S T W P I I T D X E V A C N O C D D B
E M E Q P L N Z P W Y E C C U F C L D E A A W P Q K I Z P A Y J
T N C T E H G H A K V T H W I Z I V L N L T O S U M T O E R F J
H E T Z N P E W S N E A X M E V K A M Y E T E Y C F U R G I U R
R T L X T K Y L O X K P M I I L C X I H N P A V L C H S F H N F
E R I X A B O C I J D E D V L S G K U E S Y R T U T A Q F B O G
H A N P G T L G K X U R A Q K C Q N G C O P O E W K T U N X E H
D D E K O H N A I M I P R S B P D N A H F B W E P Y C A T F G O
P I C I N T C E E L Z F Q I H T A N F T T Q R X W Y E R Y N G O
K U X M L T R P M I N J X V H T V O U U H C Q R N Y J E M V W L
L S G N I W A R D G N I K R O W R T S O S G U A L O O K O H A T
U I S O N Q P Q R R E Y X S H E O E S Z R M I B M C R O M C N X
B W R V G D O Y P E R S G S S L A J Z N J I M R Q X P Z I O J I
K N I S R E T N U O C E H H E N C O U N T E R B O R E T I M P L
V F O J W E J Q U S T T O R G N E O O A S E B C W X R T P B Z F
Y T U G W E U S M I V R A L K G D H N S H F G Q M E C R B I A T
S M J L A W E B T T T N E N X Y T F A E R T W O V E C I E G I A
B U O I F X L V S E C N B C G L Y U E R V T B S S I R X W A O X
Y C K E R C E E N E Z E N J S L E K X H S O X Z I P M Z F D M Z
Q R Z I P N C H L G W D N T X N E S N D L E Z D X J B O L R B I
```

THERE ARE 40 WORDS HERE - CAN
YOU FIND THEM?

HERE ARE THE WORDS TO LOOK FOR:

ASSEMBLY
CONE
COUNTERBORE
DIAMETER
FORESHORTEN
HEXAGON
OBJECTLINE
OCTAGON
PERPENDICULAR
RADIUS
RECTANGLE
RIGHTANGLE
ROUND
SCREWTHREAD
SEGMENT
SQUARE
TAPER
TOLERANCE
VERTICAL
WORKINGDRAWING

CONCAVE
CONVEX
COUNTERSINK
FILLET
HELIX
HEXNUT
OBTUSEANGLE
PENTAGON
PROJECT
REAM
RIB
ROTATE
SCALEDRAWING
SECTION
SKETCH
TANGENT
THREAD
TRIANGLE
WEB
ZONES

DRAFTING TERMS #1

```
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
. N . . . . . . . . . . . . . Z . . . . . . . . . . . . . . . .
. . O . . . . . . . . . . . O . . F . . E . . . . . . . . . . .
. . . G . . . . . . . . . N . . . . I L . . . . . . . . . R . .
. . . . A . . . . . . . E . . . . . G L . . . . . . G . . E . .
. . . . . T . . . . . S R . . . . N . . L . . . . N . . . T . .
. . . . . . C . . . . . . A . . A . . . . E . . I . . . . E . .
. . . . . . . O . . . . . . L I . S . . . . T W . . . . . M . .
. . O . . . . . . . . . . . R U K R . . . . A . . . . . . A . R
. . B . . . . . . . . . . T . E C . O . . R . . . . . . . I . I
. . J . . . . . . . . . X . T . . I . T D . E V A C N O C D D B
. . E . F . . . . . . E . C . . . . D E A . . . . . . . . A . .
T . C . E H . . . . U T H . . . . . L N . T . . . . . . E . . .
H . T . N . E . . N . A . . E . . A . . E T E . . . . R . . . .
R . L . T . . L O . . P . . . L C . . . N P . . . . H S . . . .
E R I . A . . C I . . E . . . S G . . E . . R . . T . O . . . .
A A N . G T . . . X . R . . . . . N G . . . O E W . T U N X E H
D D E . O . N . . . . . . . . . D N A . . B . E P . C A . . . .
. I . . N . . E . . . . . . . . A N F T T . R . . . E R . . . .
. U . . . . . . M . . . . . . T . O U U H C . . . Y J E . . . L
. S G N I W A R D G N I K R O W F T S O S G . . L . C . . . A .
. . . . . . . . R . E . . . . E O E . . R . I B . . R . . C N .
. . . . . . . . . E . S . . S L A . . . . . M R . . F . I O . .
K N I S R E T N U O C . . H E N C O U N T E R B O F E T I . . .
. . O . . . . . . . . T O R G . . O . . S . . . . . F T . . . .
. . . G . . . . . . . R A L . . . N S . . . . . . E C R . . . .
. . . . A W E B . . T N E N . . . A E . . . . . V E . . E . . .
. . . . . A . . . E C . . . G . . . . . . . . . S . . . . A . .
. . . . . . E . N E . . . . . L . . . . . . . . . . . . . . M .
. . . . . . . H . . . . . . . . E . . . . . . . . . . . . . . .
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DRAFTING TERMS #2

```
E M E M O L T A E U R J C K X J S T R I A N G L E T Z S F Z M M
R D O A Q A M C X I H J X B T G N S L H J R F H T U C N I K I S
Z A P M R W W O B H U D C P U W V O S J J U C T I D N E S Y E Q
K U W Q W X X U G O V H I L X G M T R U J O K J V E F Y J G H J
L F M C F I W N E H F M E G C W F T U E L V V Q Q J K E M O I V
N D Q I X Y Y T E U N Z S C H P I U P K C K B Y G S N E G N R H
T E G T S C R E W T H R E A D H S L W B C T R I E O N O V X M P
N N T B K X M R W O R K I N G D R A W I N G A L C T L B M D J A
E L L R M V A S V A E Z R Z C J D G J E E G G N N C A J M G O Q
G L R C O H M I C O N V E X F S M C G V R N T M G K R E Q M H E
N C A H E H N N S U I D A R G W A U I N A T F S D L L C L E Q Q
A J S O N L S K P G K R R C Q A L R D E I E R O B R E T N U O C
T P P I K I G E D H N U P O M T Y U S P Y W Y S H Q H L U D C T
J O Y P R F H N R Y E X A D T K O U A W E R A V F A J I E E R N
A S Z V U A U C A O S V D W K A T L E E N U O R P E R N R O K S
J R O E A O M Z I T F W Y B O B T P V W K L Z U D P J E O E V S
R G L N R U D H F S H S E F O T C E Q U O T G Y L E R A U Q S E
T L V V T S D L A U R G M F T D V A Q J M Z Q Z I N L A G V B C
R X E D B J K Y U C J T I J I A S N A Y X B U H P M M A I H K T
N G O S T S P C D X T M X R C L X X F Q J R S F Z X G L C M E I
Y R J G H H X J M G U K Y N P K L Z G T P R E P A T B J J S C O
I T Q S M F P G I F A U O Y F U X E W T F F O A B I Q T F S N N
T K U C G U F E V O S C M A R O G J T H Z Q P L R S N Q M A A C
S H E A Y O C H N U N Y I Z E E R T E R B M N W A V E I X P R H
T W R E R U L F T T T J K T J V T X C T E N T S L D V L H H E T
H C T E K S B W I R A L U C I D N E P R E P S N O G A T C O L D
N K W T A E Z V J E T G K X S U W X M C V E R T I C A L J Z O Z
G A I Q W D S O N R F Z O Z T A N U B A M Y Q F V M S D Q C T Z
H Z X P D O H X N U O J V N S M P P H B I J E Q A Q V R I D D X
V H C A N E V S C E Y L Y D A T Z M L O O D H E X A G O N Q L J
  C G I Z K Z E A T S W F E L J B Y U S F R W Q E M L O Z Q V R
S X L S S O F O D C X F R I Z H U I M B S Z Y G J B H E L I X Q
```

THERE ARE 40 WORDS HERE - CAN
YOU FIND THEM?

HERE ARE THE WORDS TO LOOK FOR:

ASSEMBLY
CONE
COUNTERBORE
DIAMETER
FORESHORTEN
HEXAGON
OBJECTLINE
OCTAGON
PERPENDICULAR
RADIUS
RECTANGLE
RIGHTANGLE
ROUND
SCREWTHREAD
SEGMENT
SQUARE
TAPER
TOLERANCE
VERTICAL
WORKINGDRAWING

CONCAVE
CONVEX
COUNTERSINK
FILLET
HELIX
HEXNUT
OBTUSEANGLE
PENTAGON
PROJECT
REAM
RIB
ROTATE
SCALEDRAWING
SECTION
SKETCH
TANGENT
THREAD
TRIANGLE
WEB
ZONES

BEST COPY AVAILABLE

DRAFTING TERMS #2

```
. . . . . . . . . . R . . . . . . T R I A N G L E T . . . . . .
. . . . . . . C . I . . . . . . . . . . . . . . . . C . . . . S
. . . . . . . O B . . . . . . . . . . . . . . . . . . E . . E .
. . . . . . . U . . . . . . . . . . R . . . . . . . . . J G . .
. . . . . . . N . . . . . . . . . . . E . . . . . . . E M O . .
N . . . . . . T . . . . . . . . . . . . C . . . . . N E . . R .
T E . . S C F E W T H R E A D . . . . . . T . . E O N O . . . P
N . T . . . . R W O R K I N G D R A W I N G A L C T . B . . . .
E . . R . . . S . . . . . . . . . . . . . . G N . . . J . . . .
G . . . O . . I C O N V E X . . . . G . . N . . G . . E . . . .
N . . . E H . N S U I D A R . . . . . N A . . . . L . C . . . .
A . . . . L S K . . . . R . . . . . . E I E R O B R E T N U O C
T . . . . . G E D . . . . O . . . . S . . W . . . . . L . . . .
. . . . . . . N R . . . . . T . . U . . . . A . . . . I . . . .
. . . . . . U . A O . . . . . A T . . . . . . R . . . N . . . .
. . . . . O . . . T F . . . . B T . . . . . . . D . . E . . . S
. . . . R . . . . . H . . . O . . E . . . . . . . E R A U Q S E
. . . . . . . . . . . G . F . . V . . . . . . . . . L . . . . C
. . . . . . . . . . . . I . I A . . . . . . . . . . . A . . . T
. . . . . . . . . . . . . R C L . . . . . . . . . . . . C . E I
. . . . . . . . . . . . . N . . L . . . . R E P A T . . . S C O
. . . . . . P . . . . . O . . . . E . . . . . . . . . . . . N N
T . . . . . . E . . . C . . R . . . T H . . . . . . . . . . A .
. H . . . . . . N . . . . . . E . . E . . . . . A . . . . . R .
. . R . . . . . . T . . . . . . T X . . . . . S . . . . . . E .
H C T E K S B . . R A L U C I D N E P R E P S N O G A T C O L .
. . . . A E Z . . . . G . . . U . . M . V E R T I C A L . . O .
. . . . W D . O . . . . O . T . . . . A M . . . . . . . . . T .
. . . . . . . . N . . . . N . M . . . B I . . . . . . . . . . .
. . . . . . . . . E . . . . A . . . L . . D H E X A G O N . . .
. . . . . . . . . . S . . E . . . Y . . . . . . . . . . . . . .
. . . . . . . . . . . . R . . . . . . . . . . . . . H E L I X .
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BEST COPY AVAILABLE

DRAFTING TERMS #3

```
K L T Z K T A N G E N T D T A A D E C G G R K K K I P G A X X H
A A G Q I O Z N F U U W H K A J W R I Z D S K K P E Y M M D P I
J T L E D A J M F O G S R S L X U C X T N L G U R R W V S U R R
T A V V I F L P W R W Y S G I J T P Q E K R Y P B K X U H A P O
E U G D N S H A H X H E M L R O G P G K B O E S I L G N A F Y B
N O N L Y P A J R U M A E W E C X L E L G N A T H G I R W E B J
G M E X B W L L I B E H O N Z T O Y J E D W U Q E N F F R I Q E
C Y R H E D A D L R G R V X W A H G N I B I Y H R M G Q Z T T C
V D K R Y H R Y L L K P C Z Q G M C C P T W D X C G A C W C Z T
C V S O C U R A I I W E P F P O O U T A P E R T K T E I I E P L
R O O O S T C Z N F I L L E T N L F O R E S H O R T E N D J F I
A B U T U I H G E X F C P S C A L E D R A W I N G W L K K O C N
D B Z N T A D R W V Z K O O R Y S O D Z L A V N U F G U S R D E
I L L R T R R E E O E C J N S J T P A I F S I V S U N Z A P D B
U S E K A E G E J A O I V K C Q V G Y A V V U R I B A D P I D N
S V E W I S R H I J D C H F N A D J H Y L N I Q B E T W Z H A Q
I T I L X F P S A G H J Y R R S V U J R P S A H Q Y C J X C E R
Q N E V D B W C I E V B Y L E J O E W O P F E T R I E Y R W R F
G F H D M F V T Y N F X N H S L X X E V N O C N X E R C A Z H R
R F A L K O P L U H K S L H N W G D E Z K U B T O O Q L T Y T F
F Y H A H P B F A Q Y F R X N O B N E D T P R T O Z Z X I W W L
F I I O H R P E C N A R E L O T G D A V T K T E U E Z R W F E L
Z O S E G M E N T H M Y Y Q N O N A O I L Q O S D S D W X I R F
V J W N A R J T H U Y F C O H U P U X X R M X Y N T E K U S C K
K F L S J N Z K Z K N T G N O A N X N E R T C O C U M A V W S W
A X W D A O W U N I X A W R L I Q M D E H M I C N T C C N X N B
X O G X A E J K W B T T A G H L V C H A C T V N M M A J J G J I
P Y S Y M L A O Y N R O T A T E G N N C C F Q Q I Z Y G F S L J
F L P E R J C A E C T M C C E R O B R E T N U O C J K V K D Q E
C O D O I I R P N C P Y Q K C N W L S B L W K E M C O N K L Z A
O V Z C N B E W F V Y M P T X T I T B B R D K T F R G S Q G R C
S D S Z Y W H J J K U N N K N L N B X M M A H M E N R R U I G I
```

THERE ARE 40 WORDS HERE - CAN
YOU FIND THEM?

HERE ARE THE WORDS TO LOOK FOR:

ASSEMBLY
CONE
COUNTERBORE
DIAMETER
FORESHORTEN
HEXAGON
OBJECTLINE
OCTAGON
PERPENDICULAR
RADIUS
RECTANGLE
RIGHTANGLE
ROUND
SCREWTHREAD
SEGMENT
SQUARE
TAPER
TOLERANCE
VERTICAL
WORKINGDRAWING

CONCAVE
CONVEX
COUNTERSINK
FILLET
HELIX
HEXNUT
OBTUSEANGLE
PENTAGON
PROJECT
REAM
RIB
ROTATE
SCALEDRAWING
SECTION
SKETCH
TANGENT
THREAD
TRIANGLE
WEB
ZONES

DRAFTING TERMS #3

```
. . . . . T A N G E N T . . . . . . . . . . . . . . P . . . . .
. . . . . . . . . . . . . . A . . . . . . . . . . E . . . . . .
. . . . . . . . . . . . . S . X . . . . . . . . R . . . . . . .
T . . . . . . . . . . . S . I . . . . . . R . P . . . . . . . O
E U . . . . . . . . . E M L . O . . . . . . E . . . . . . . . B
N . N . . . . . . . M A E W . C . . E L G N A T H G I R W E B J
O . . X . . . . . B E H O . . T . . . . D . . . E . . . . . . E
C . . . E . . . L R . R . . . A . . . I . . . H . M . . . T . C
. . . . . H . Y L . K . . . . G . . C . . . . . C . A . . C . T
C . S . . . . A . I . . . . . O . U T A P E R . . T . I . E . L
R O . C . T C . N F I L L E T N L F O R E S H O R T E N D J . I
A . U . U I H G . . . C . S C A L E D R A W I N G . L K . O . N
D . . N T A D R . . . . O . R . . . . . . . . . . . G . S R . E
I . . R T R R . E . . . . N . . . . . . . . . . . . N . . P . .
U . E . A E . E . A . . . . C . . . . . . . . R I B A . . . D .
S V . W . . R . . . D . . . . A . . . . . . . . . . T . . . A .
. . I . . . . S . . . . . . . . V . . . . S . . . . C . . . E .
. N . . . . . . I . . . . . E . . E . . . . E . . . E . . . R .
G . . . . . . . . N . . . . . L . X E V N O C N . . R . . . H .
. . . . . . . . . . K . . . N . G . . . . . B . O . . . . . T .
. . . . . . . . . . . . . . . O . N . . . . . T . Z . . . . W .
. . . . . . . E C N A R E L O T G D A . . . . . U . . . . . E .
. . S E G M E N T . . . . . N . N A . I . . . . . S . . . . R .
. . . . . . . . . . . . . O . U . . X . R . . . N . E . . . C .
. . . . . . . . . . . . G . O . . . . E . T . O . . . A . . S .
. . . . . . . . . . . A . R . . . . . . H . I . . . . . N . . .
. . . . . . . . . . T . . . . . . . . . . T . . . . . . . G . .
. . . . . . . . . N R O T A T E . . . . C . . . . . . . . . L .
. . . . . . . . E . . . . . E R O B R E T N U O C . . . . . . E
. . . . . . . P . . . . . . . . . . S . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .
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DRAFTING--TECHNICAL TERMS

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Z R T X U L J G E M Q U Y P O C I R C U M F E R E N C E I P B K
S N P W J U I B G M M F V V D X C Y U Y K C O G K G D U M G X E
M M J S I H U T B E F O E A J S L C X K N Q U T O P Y F T L J H
H T M C F U Y H R I C N B E I F A H A A P A C S T Z G X R P I P
L A N O G A I D U L F P P Q Z N Z S W A K T K G C I G F U I T H
W I H T A S R E D I V I D O T I M O S Y P Q C L E O R K B S R W
T U U O L D R R C U I H E I Z I L I A Y V M A D U Q N C P V C T
A C C U R A T E D F Q Z L R G L L I K Q Q R B M D Y I T I U S O
Z T W W S J Y P Q Z H E W M A L Q B O Y E V B A W R C C O Y T N
K S T I T E J I T Y V F V U I F Y Y Z T D E Z I T H Y I M U M W
U I F F F S C L O E O J A R K V A R A Q R P S N I E F N U S R X
T X Q B H E S A R V G B D F M G B L F J X V E P F I K X U S Q J
W A S V D O W C E I V M G R F A I A R U A C R I I B X Q G W C A
A G V H S V W P R G K X E B K U M E S D C E T D F L D W D N V M
R G Z X X S T D B L J D C J Q F F D D E T I N X X V L X C I J D
D T W E L T E F F M N E D E J M X H U E T L N F O W O E I F B F
V E K M K R D T A I P G J B A L C W M C J I K S K I L E R B H W
G W P N X G K U L R M J T H E G I A B O R E G N C V F N C Z E W
K B T X X C L Y M D D N C A E H I U H A N W N E F R P X L R W L
W G P M I W C T W S E O L G R D H Z K P R X Y X T R I J E H G Y
K X P O T R E M P M N N H J V C M K H G B Q B T S U A B Y B Y P
A Z N W T C H G P C O D A M E N   H J C N J W Z G Z O Q E F T I
A L F C V H N O E I T C E C A F I N B S H I Z I Q O F Z C Y Y H
L O V R E O L N T R T C U F U G N I R A E B T I W B F L Q K D F
V V K A J E T A O R L Z B S A T A A N A E B A O L B R G I Y S P
K A H V V R V S T E O H I G M V E Z F C H U Z W O Z T P S H M U
V B S E I E S R A A R S N A E F X   L I L T Q B S F L M Z X S K
X T D C L C G R O V A S I Y Y D Q S A A E I N W O D H A U K K M
G X Y E S C A F O R G E O L L N M Q D N L Z N N Z S C M P Z B M
L V L X D N O L H S R Y I Z B Q A T Y V G M T E R O A E N D T Q
L Y S D C B W T X W U G E I W M Q L B J N L L E V E B J Y M M G
F J A E V P B W U Z A S I A W E B U N Y A M E F V J S O N V L S
```

THERE ARE 35 WORDS HERE - CAN
YOU FIND THEM?

HERE ARE THE WORDS TO LOOK FOR:

ACCURATE
ALLOWANCE
ARC
BEARING
BORE
CANTILEVER
CIRCLE
CLEARANCE
CONTOUR
DEVELOPMENT
DIAMETER
DRAFT
ECCENTRIC
ELLIPSE
FACE
FOOTING
GIRDER
INSCRIBE

ACUTE ANGLE
ANGLE
AXIS
BEVEL
CALIPER
CHAMFER
CIRCUMFERENCE
CONCENTRIC
CYLINDER
DIAGONAL
DIVIDERS
DRILL
ELEVATION
EQUILATERAL
FIT
FORGE
INCLINE

DRAFTING--TECHNICAL TERMS

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. . . . . . . . . . . . . . . C I R C U M F E R E N C E . . . .
. . . . . . . . . . . . . . . . . . . . . C . . . . . . . . . .
. . . . . . . . . . . . . . . . . C . . N . . . . . . . . . . .
. . . . . . . . . . . . . . . . A . . A . . . . . . . . . . . .
L A N O G A I D . . . . . . . N . . W . . . . . C . . . . . . .
. . . . . S R E D I V I D . T . . O . . . . . L . O . . . . . .
. . . . . . . R . . . . . I . . L . . . . . A . . . N C . . . .
A C C U R A T E . . . . L . . L L . . . . R . . . . I T . . . .
. . . . . . . P . . . E . . A L . . . . E . . . . R . . O . . .
. S . . . . . I . . V . . . I . . . . T . E . . T . . . . U . .
. I . . . . . L . E . . . R . . . . A . . . S N . . . . . . R .
. X . . . . . A R . G . D . . . . L . . . . E P F . . . . . . .
. A . . . . . C . I . . . R . . I . R . . C R I I . . . . . . .
. . . . . . . . R . . . E . . U . E . . C E T . . L . . . . . .
. . . . . . T D . . . D . . Q . F . . E T I . . . . L . C . . .
. . . . . . E F . . N . E . . M . . . E . . N . . . . E I . . .
. . . . . R . . A I . . . . A . . M . . . . . S . . . . R . . .
. . . . . . . . L R . . T H . . . A B O R E . . C . . . C . . .
. . . . . . . Y . . D N C A . . I . . . . . . . . R . . L . . .
. . . . . . C . . . . E O . R D . . . . . . . . . . I . E . . .
. . . . . . . . . M N N . . . C . . . G . . . . . . . B . . . .
. . . . . . . . P C O . A . . .   . . . N . . . . . . . E . . .
. . . . . . . O E I . . E C A F . . . . . I . . . . . . . . . .
. . . . . . L N T . . C . . U G N I R A E B T . . . . . . . . .
. . . . . E T A . . L . . . . T . . N . . . . O . . . . . . . .
. . . . V R V . . E . . . . . . E . . C . . . . O . . . . . . .
. . . E I E . . A . . . . . . . .   . . L . . . . F . . . . . .
. . D C L . . R . . . . . . . . . . A . E I . . . . . . . . . .
. . . E . . A F O R G E . . . . . . . N L . N . . . . . . . . .
. . . . . N . . . . . . . . . . . . . . G . . E . . . . . . . .
. . . . C . . . . . . . . . . . . . . . N L L E V E B . . . . .
. . . E . . . . . . . . . . . . . . . . A . E . . . . . . . . .
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DRAFTING--TECHNICAL TERMS PUZZLE #2

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U E V U E X V P D I R H Q Y N T R G G H L G P L L A S U N K C X
J R O F U O N O N T U G V J H Z L U I C G E Z Y R S S R U G L U
C L Q P H C K M T C B H U Q O D J U J O I T F C E C T E Q J I X
X D O Z P E O I Y P V T G X Z I K I Q L H R   W Y J K T M U S G
W R E T I T W A R U A E I I C C B A B K U J T K W H C E V N U S
C C O A U Y Y Q W P H L O K G S K I O Y C O K N E I L M J X V Y
H K C Z Q N E F V M I D E Y G F K R E T W A B V E W K A W I Q P
V V D G A Q D Q G E H J H D E R Q L A G N A Q S V C O I A M R O
A X U B B G B D U I X L J R P S O M G S C E O R Z C C D P O P P
T H X H D S Q E B I N H S A V I C V R M I E M U K Y A E T F G R
E U P I S R E J C C L S R F D E V A R W T W B P L G V V G A W G
L J Q Y S N U L J O Z A C T Q K W G O Y T T Y I O J A E X W K M
E A Q R N A D B G R R V T R B K F J V H X F N C V L E C L E E C
L R N P B L Y A X N T X Z E I L V E A Z U D G A S H E E H C X S
L G Z O G E G T K Y A W X U R B H C L F E O Y N P C V V A X P S
I F C Q G Y K Y R T R   Q M R A E N B R Q X L T V E A F E E L R
P N H Y M A O F D L E Y E X J G L A J L X M L I B A P W R D C E
S W G B H K I G Y C P D L T K B S W C U R M S L E I L O G L P D
E I Y H O U O D O F I O W V U I D O K I Y S D E Z T B Z E H F I
C I R T N E C N O C L W N A J C F L M I R X P V D U A A S T A V
R C O T I K T E X A A Y X T Y Y A L F R P C J E I T R R G Y Q I
C Z O I T O L L G N C I X R A J O A D I D P U R X A V N U T J D
H L J O U G W N L W S H B V G X E T K R D P F M N C I A H C Y V
A V U R N Y J H K H H W S A D C T L I X I N B C F R F H X D C H
M X H A V K C O E B W L C Z J I S L C H O I E O A E R U S B W A
F P M J J F O E Z I P N M V E U L D C R I K Q E Y F R O U L O R
E C B X J D M Z E L E V A T I O N Y Z M I I B X U E E E E H H I
R S M Z T W V J U F H B M N T C L P W P Z C E J M W J J N H W Q
S O S C F G W Y S M O O D K G R G U R E D R I G Y W O J X C F V
F E W A E N I L C N I R V M B N K M T E F O O T I N G F M L E X
M S K I W P P K K O A I G O R F H I H K Y S P I K B T Y K N X G
P Z Q V T O U T O E R D H E A K F E O M R A M M R J J K C S L A
```

THERE ARE 35 WORDS HERE - CAN
YOU FIND THEM?

HERE ARE THE WORDS TO LOOK FOR:

ACCURATE
ACUTE ANGLE
ALLOWANCE
ANGLE
ARC
AXIS
BEARING
BEVEL
BORE
CALIPER
CANTILEVER
CHAMFER
CIRCLE
CIRCUMFERENCE
CLEARANCE
CONCENTRIC
CONTOUR
CYLINDER
DEVELOPMENT
DIAGONAL
DIAMETER
DIVIDERS
DRAFT
DRILL
ECCENTRIC
ELEVATION
ELLIPSE
EQUILATERAL
FACE
FIT
FOOTING
FORGE
GIRDER
INCLINE
INSCRIBE

DRAFTING--TECHNICAL TERMS PUZZLE #2

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. . . . . . . . . . . . . . . . . . . . . . . . . A . . . . . .
. . . . . . . . . . . . . . . . . . . C . . . . R . . R . . . .
. . . . . . . . . . . . . . . . . . . . I . . C . . . E . . . .
. . . . . . . . . . . . . . . . . . . . . R . . . . . T . . . .
. . . . . . . . . . . . . . . . . . . . . . T . . . . E . . . .
. . . . . . . . . . . . . . . . . . . . . . . N . . . M . . . .
. . . . . . E . . . . . . . . . . . . T . . . . E . . A . . . .
. . . . . . . O . . . . . D . . . . . . N . . . . C . I . . . .
. . . . . . . . U I . . . R . . . . . . . E . . . . C D . . . .
. . . . . . . . . I N . . A . . . . . . . . M . . Y . E . . . .
. . . . . . E . . . L S . F . . . . . . . . . P L . . . . . . .
L . . . . . . L . . . A C T . . . . . . . . . I O . . . . . . .
E A . . . . . . G . . . T R . . . . . . . . N C . L . . L . E .
L . N . . . . . . N . . . E I . . E . . . D . A . . E E . C . .
L . . O . . . . . . A . . . R B . C . . E . . N . . V V A . . S
I . . . G . . . . . R   . . . A E N . R . . . T . E . F E E . R
P . . . . A . . . . E . E . . . L A . . . . . I B . . . R D C E
S . . . . . I . . C P . . T . . . W C . . . . L E . . O . L . D
E . . . . . . D O . I . . . U . . O . I . . . E . T B . E . . I
C I R T N E C N O C L . . A . C . L . . R . . V . . A A . . . V
. . . . . . T E . . A . X . . . A L . . . C . E . . R R G . . I
C . . . . O L . . . C I . . . . . A . . D . U R . A . N U . . D
H . . . U G . . . . S . . . . . E . . R . . . M N . I . . C . .
A . . R N . . . . . . . . . . . . L I . . . . C F R . . . . C .
M . . A . . . . . . . . . . . . . L C . . . E . A E . . . . . A
F . . . . . . . . . . . . . . . L . . R . . . E . . R . . . . .
E . . . . . . . E L E V A T I O N . . . I . B . . . . E . . . .
R . . . . . . . . F . . . . . . . . . . . C . . . . . . N . . .
. . . . . . . . . . O . . . . . . . R E D R I G . . . . . C . .
. . . . E N I L C M I R . . . . . . T . F O O T I N G . . . E .
. . . . . . . . . . . . G . . . . I . . . . . . . . . . . . . .
. . . . . . . . . . . . . E . . F . . . . . . . . . . . . . . .
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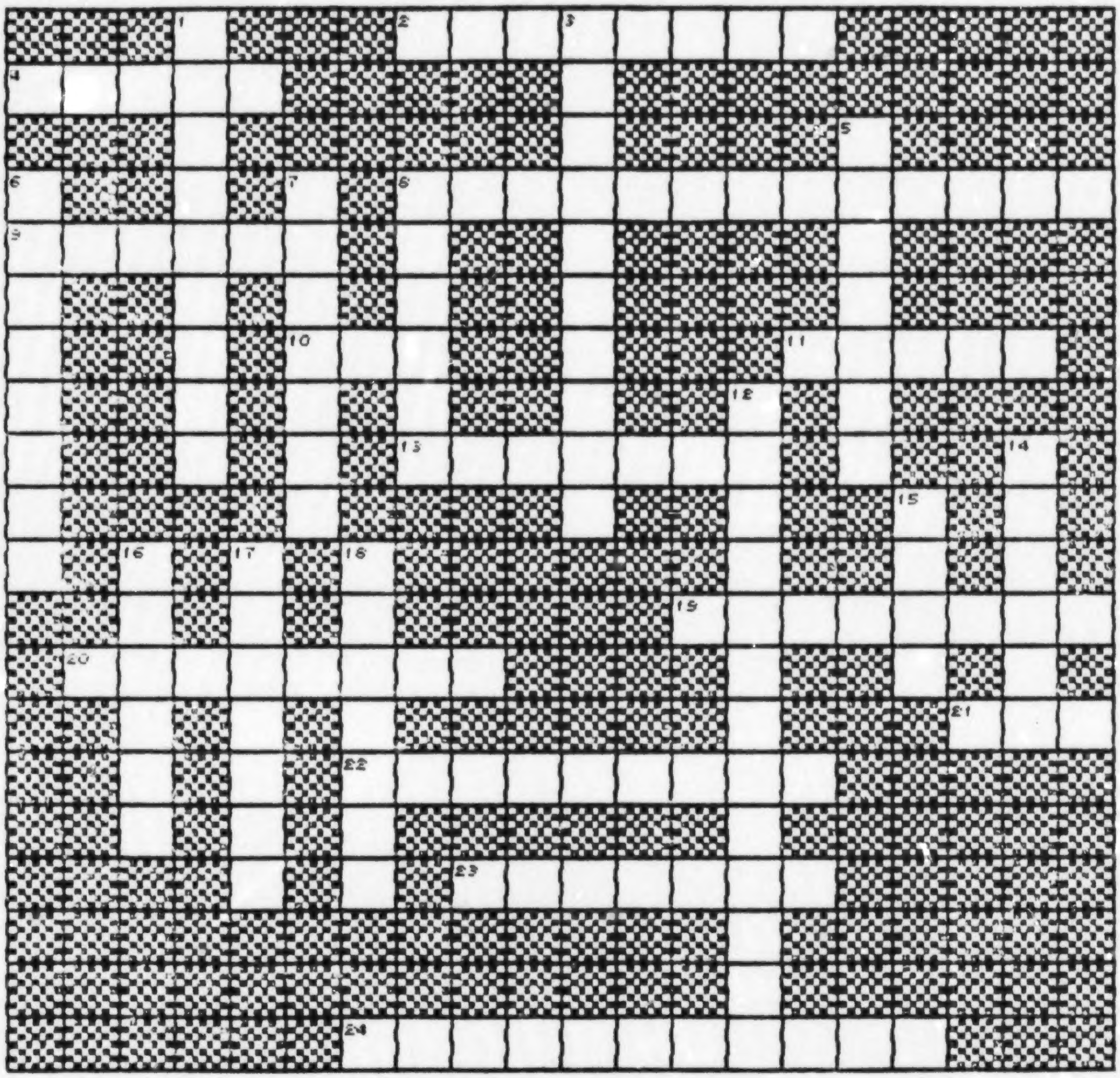
DRAFTING PUZZLE



ACROSS CLUES

2. TO DRAW ONE FIGURE WITHIN ANOTHER
4. LINES COMING TOGETHER AT A POINT
8. THE PERIMETER OF A CIRCLE
10. PORTION OF A CIRCLE
11. WHEN AT 45 DEGREES, IS CALLED A MITER
13. CLOSED CURVE IN THE FORM OF A SYMMETRICAL
19. AT RIGHT ANGLES TO THE HORIZONTAL PLANE
20. A FIVE-SIDED FIGURE
21. A THIN, FLAT PART JOINING LARGER PARTS
22. NOT HAVING A COMMON CENTER
23. THE OUTLINE OF A CIRCLE
24. TO SHOW LINES SHORTER THAN THEIR TRUE LENGTHS

DOWN CLUES

1. FRONT VIEW OF A HOUSE
3. HAVING A COMMON CENTER
5. TO EXTEND FROM
6. A THREE-SIDED FIGURE
7. A SIX-SIDED FIGURE
8. A CLOSED CURVE
12. A LINE AT A RIGHT ANGLE TO ANOTHER LINE
14. A FOUR-SIDED FIGURE HAVING ALL SIDES EQUAL AND 90 DEGREE ANGLES
15. CENTRAL LINE OF A DRAWING
16. DRAW WITHOUT AID OF DRAFTING INSTRUMENTS
17. AN EIGHT-SIDED FIGURE
18. PART OF A LINE

ANSWERS: DRAFTING PUZZLE

			E				I	N	S	C	R	I	B	E					
A	N	G	L	E						O									
			E							N					P				
T			V		H		C	I	R	C	U	M	F	E	R	E	N	C	E
R	O	T	A	T	E		I			E					O				
I			T		X		R			N					J				
A			I		A	R	C			T				E	E	V	E	L	
N			O		G		L			R			P		C				
G			N		O		E	L	L	I	P	S	E		T			S	
L					N					C			R			A		Q	
E		S		O		S							P			X		U	
		K		C		E						V	E	R	T	I	C	A	L
	P	E	N	T	A	G	O	N					N			S		R	
		T		A		M							D				W	E	B
		C		G		E	C	C	E	N	T	R	I	C					
		H		O		N							C						
				N		T		C	O	N	T	O	U	R					
													L						
													A						
						F	O	R	E	S	H	O	R	T	E	N			

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